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The
GEOGRAPHICAL JOURNAL

Vol LXXI No 5 R.G.S. *May 1928*

THE NANDA DEVI GROUP AND THE SOURCES OF THE NANDAKGINI: *Read at the Meeting of the Society, 9 January 1928, by*

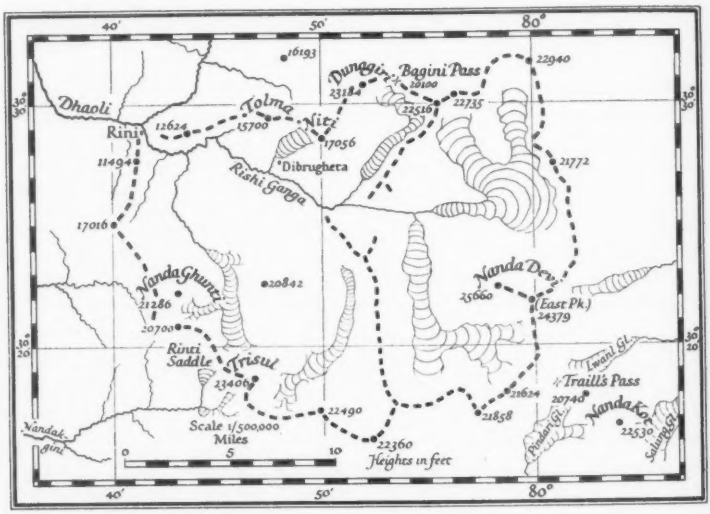
T. G. LONGSTAFF, M.D.

NANDA DEVI (25,660 feet) in the Garhwal Himalaya is the highest mountain situated entirely within British territory. There are no "political" difficulties to prevent anybody going there at any time. Its neighbourhood can be reached very quickly, easily, and cheaply from railhead at Kathgodam. In spite of this no one has yet succeeded in reaching the actual base of this grand mountain, much less in setting foot on it.

No doubt one reason is because, in this particular climatic zone, the winter snow does not disappear until June, while in the Rains travel in the southern valleys is so dangerous to health and so unbearably unpleasant. But quite apart from this the topography of Nanda Devi presents difficulties of access which I believe are unique. The mountain rises from the middle of an almost complete crater-like amphitheatre of mountains whose walls are 20,000 feet high, which has neither been crossed nor entered by any human foot. On the east the highest peak rises abruptly from the end of a buttress 2 miles long and about 23,000 feet in height, which connects it with a separate mountain, Nanda Devi East, 24,379 feet. On all other sides it rises a sheer 10,000 or 12,000 feet from the glaciers which encircle its base But this central "crater" is only part of another almost complete ring of mountains measuring full 70 miles in circumference, from the crest of which spring a dozen *measured* peaks of over 20,000 feet, including Dunagiri on the north, Nanda Devi East, and on the south Trisul and Nanda Ghungti. For 60 miles of this distance there is no known depression below 17,000 feet, and in this distance it has only once been crossed, by the Bagini Pass, 20,100 feet (see *G.J.* 31, 367). This defensive crest-line has also been reached, but not crossed, in three other places: at 19,000 feet 2 miles south of Nanda Devi East (*G.J.* 29, 202), on the summit of Trisul, and last summer at 17,000 feet on the Rinti Saddle.

Down the centre of these two concentric horseshoes flows the Rishi-

ganga, which joins the Dhaoli river at Rini at an altitude of only 6000 feet. The distance between Rini and Nanda Devi is but 20 miles, so that both the actual drop and the angle of steepness is considerably more than on the northern slopes of Mount Everest. The drainage of some 250 square miles of glaciated mountain country would be expected to make something remarkable in the way of a trench, when limited to one outlet; but however great the difficulties anticipated it would be expected that the Rishi valley would provide easier access to the inner sanctuary than climbing over a 20,000-foot wall. Yet the Garhwalis, good rock climbers and brave men as they are, affirm that the lower half of the Rishi gorge is quite impracticable. In 1883 that redoubtable mountaineer, W. W. Graham, with two celebrated guides, Emil Boss and Ulrich



The crest-lines of the Nanda Devi group

Kauffmann, tried to force the passage from Rini, but were stopped after going a very short distance by the sheer difficulties of the ground (*Proc. R.G.S.*, New Series, 6, 433). Another trouble is that this mysterious valley is "a savage place . . . holy and enchanted" into which the local people have a superstitious dread of entering, and local coolies are therefore apt to bolt at any moment from mere unreasoning fear. It is the traditional home of the Sat Rishi, the Seven Wise Men, who are now translated to the constellation of the Great Bear.

The valley has never been inhabited, but every summer the Tolma shepherds bring a few sheep and goats across the cliffs, at 14,700 feet, just west of Tolma peak (see map, *G.J.* 31, 472) to pasture for two months in the little side glen of Dibrugheta, which hangs high above

Phot. Mr. H. Ruttledge

Nanda Devi from ridge near Traill's Pass

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Phot. Mr. H. Ruttledge

Nanda Devi from above Bilju–Milam road

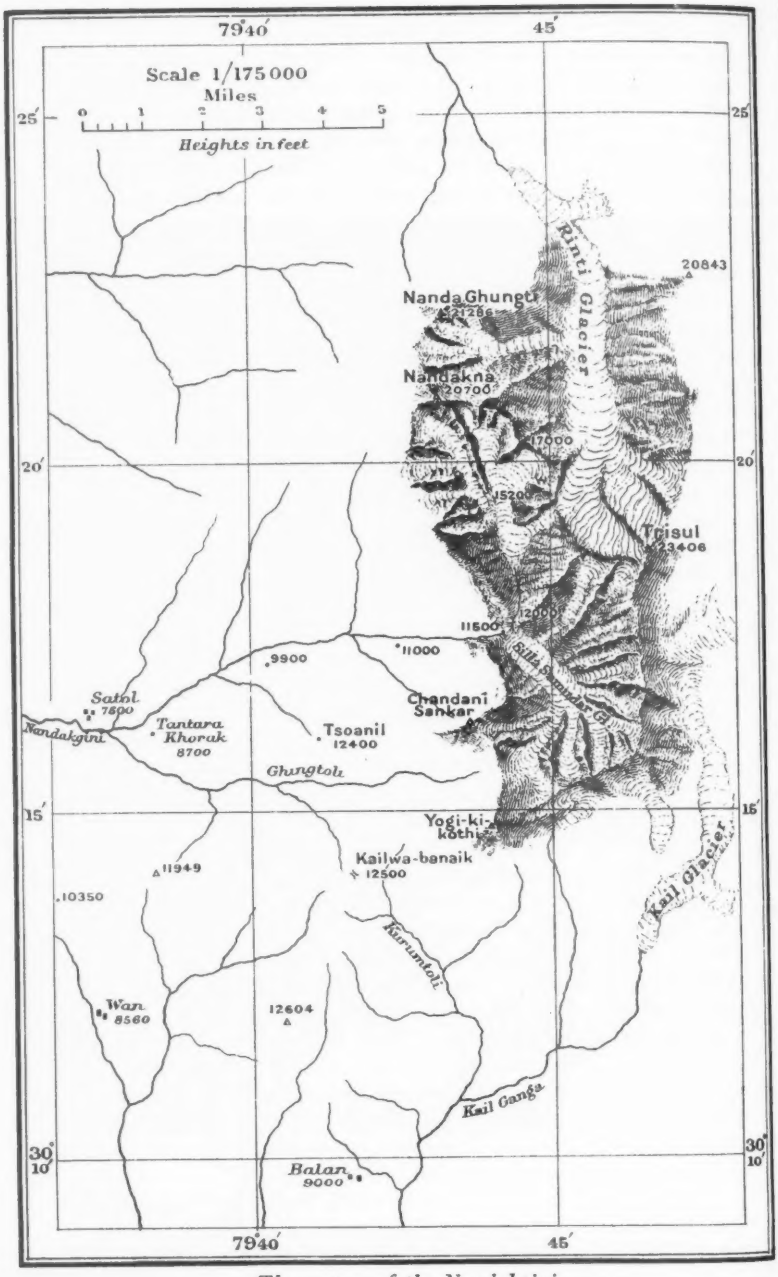
the northern bank of the Rishiganga. Using this route, both Graham's party in 1883 and General C. G. Bruce, the late A. L. Mumm and the writer in 1907, reached the banks of the Rishiganga about the middle point of its course; both parties were however defeated by the difficulties of the upper end of the gorge where the two arms of the inner crater-like amphitheatre almost close upon one another, so that the glaciers at the foot of Nanda Devi remain untrodden to this day: and when the foot is reached you find an Ushba with 10,000 feet added to her stature.

In 1905 (*G.J.* 29, 201–11 and *Alpine Journal*, 23, 202–228) and in 1907 (*G.J.* 31, 361–395 and *A.J.* 24, 107–133) I had explored practically all the approaches to this inviolate sanctuary. But a combination of adverse circumstances had prevented me, in August 1907, from pushing home an attempt to penetrate to the glacier sources of the Nandakgini river. Rising from the western foot of Trisul and from the southern slopes of the next peak on the north-west, which is definitely known to the natives as Nanda Ghungti (*i.e.* Nanda in her bridal veil), the Nandakgini river flows in a westerly direction to join the Alaknanda at holy Nandprayag. It was obvious that there ought to be a pass between Trisul and Nanda Ghungti; and that if this was an easy one it might give quicker access to the Rishi valley than the northern route used for the successful attack on Trisul in 1907. But nothing whatever was known of the topography, and diligent research has convinced me that no European had ever reached the glaciers in this neighbourhood.

In May 1927 Mr. Hugh Ruttledge, I.C.S., Deputy Commissioner of the Almora District, obtained a month's leave and invited me to accompany him and his wife on a further exploration of this valley.

He is greatly esteemed by the various peoples of his huge district for visiting even the remotest corners of it and for his devotion to their sacred Himachal: with his wife he made the only *pari karma*, or ceremonial circuit of Kailas, which has ever been performed by Europeans. In company with Col. Commandant R. C. Wilson, D.S.O., they made the first modern passage of Traill's pass in 1926. Such activities, even if unblessed by his official superiors, greatly add to his prestige as a District Officer with his people. He made all arrangements for our trip, including the enlistment in Darjiling and fitting out of six Sherpas, of whom Chettan served with the second Mount Everest expedition and Lewa with all three: Lewa was one of the two saved alive from the avalanche by Mallory, Somervell, and Crawford in 1922. Col. A. H. R. Dodd, commanding the 1st/3rd Q.A.O. Gurkha Rifles, most kindly lent us two picked men, Riflemen Khare and Budha Singh, who were of great service to us. All our men worked splendidly.

Leaving Gwaldam on May 15 we made three long marches by the Wan Pass (about 10,350 feet) to Satol, which was reached on May 17. Satol (about 7500 feet) is the highest village on the Nandakgini, and



The sources of the Nandakgini

became our base, where all servants and all but the lightest equipment were left behind. We were told at Satol that about every twelve years a regular pilgrimage was made to Silla Samudr (or Samudar), the terminal ice-cave in the glacier from which the Nadakgini river appears to rise. The name was said to mean Source of the Ocean. We were told that on these occasions two thousand goats were sacrificed there; but we were also told that exceedingly few of the pilgrims ever arrived at their journey's end—and we never found even a bone of one goat! The performance of the pilgrimage appears to be a sort of perquisite of the villagers of Satol, for the which they are paid a regular fee. I think it must be to this pilgrimage that Atkinson refers ('Himalayan Districts,' 3, 634): "The summit (of Nanda Devi) is altogether inaccessible; but over a mile below it, a *mela* or religious festival is held every twelfth year, though access to the spot is so difficult that it is reached by scarcely fifty of the pilgrims who make the attempt. Further progress is impracticable in consequence of the mural cliffs of ice which on every side encase the peak. . . ." But Silla Samudr is 15 miles south-west of the peak. There is a great erratic beside the Salung glacier, 10 miles south-east of the peak, which I was told by my coolies in 1905 was a place of pilgrimage for the worship of Nanda Devi, and in 1907 I saw a celebration in her honour at a village 30 miles west of the mountain. In the course of three journeys in this district on all sides of the mountain and during which I have always been on good terms with the villagers and hillmen, I have failed to get any evidence of a near approach to the mountain from any side: all were unanimous in denying the possibility of any access up the Rishi valley. I had been told twenty years ago that the head of the glen was guarded by a large and malevolent serpent, which some said was petrified and some said ate all comers, and we now heard that a party of travellers, who once long ago essayed a passage across the range, were destroyed by an avalanche hurled from the top of Trisul by Shiva, who was incensed at their approach to his Veiled Bride (Nanda Ghungti). While there was no suggestion of any objection to our party proceeding, no villager was willing to accompany us; nor could any detail of the route be obtained. But an old soldier, Bhawan Singh Negi, who had greatly distinguished himself in France with the Royal Garhwal Rifles, offered to do his best for us although he had never been that way himself. Our party was now cut down to the two Gurkhas and six Sherpas, with a few of our old coolies who would be sent back to Satol when the glaciers were reached.

On May 18 we climbed the steep track, past the old temple of Tantara (about 8700 feet), by which sheep and goats are taken in summer up the *Kharak* or summer grazing alp of Dagwal. Soon after passing this small temple we turned from the track into feathery bamboo jungle under the dense shadow of great forest trees, and keeping our height gradually approached the gorge of the Nandakgini to the north of us,

on our left. The track was now very narrow and sometimes precipitous At 4 p.m. we camped in dense wet jungle at about 9900 feet.

May 19 was a very hard day. Very soon the " path " quite disappeared. The dwarf bamboo got thinner as we left the oak and maple and entered the fir and rhododendron zone. Before noon we got down into the bed of the Nandakgini, here about 11,000 feet, but were very soon forced up again into snow-bent birch and mauve rhododendron jungle, very fatiguing to the passage of laden men. Opposite to us, extending along the sunny north bank of the gorge, was a beautiful forest of large crimson tree-rhododendron contrasting gorgeously with the dark foliage of great scattered firs. The last two-thirds of a mile took us two hours to cover ; our laden men were far behind, and at one o'clock we stopped to camp on the only level spot we had seen all day, the top of a birch-clad spur thrust out into the valley between two great gullies filled with winter avalanche snow. We had the usual pre-Monsoon rainstorm, which turned to hail in the evening.

I was very interested to see that we were, at about 11,000 feet, near the upper edge of a very fine continuous birch forest. This proved that we had reached a region never visited even by the hardy shepherds of Garhwal. In northern latitudes the silver birch is normally the last tree met with. It would be the same in the Himalaya were it not for centuries of grazing by sheep and goats. These, by destroying every seedling, inevitably cause the ultimate death of the forest, so that birch woods are now decidedly rare in this part of the Himalaya. I consider that the same conditions hold good in the Alps, where I have only seen well-grown birch in parts of Dauphiny which are too steep to graze. The normal existence here of these extensive birch woods naturally leads to the consideration of the real biological boundary between the palæarctic and the Indian faunal regions. In the Central Himalaya this lies at an altitude of about 12,000 feet along the *southern* slopes of the range, and not along the Indo–Tibetan water-parting, as is often assumed. This was strikingly emphasized in the upper Nandakgini valley, where from the bamboo jungles far below us the notes of tropical birds like the " Koel " contrasted with those of the (apparently) European cuckoo in the highest birch zone. The gorgeous tropical butterflies of the depths of the valley are exchanged for homely looking species above the tree-line. The Bharal (*Ovis nahura*) is also found on these southern Himalayan slopes, though it is generally considered typical of the more arid inner zone of the Indo–Tibetan water-parting. We have here a beautiful example of high altitude compensating for low latitude in its effect on the faunal character of a region.

Next day we continued on our way, almost at once having to cut steps across a steep, broad snow-filled gully. This was followed by steep slopes through the last of the dwarfing birch forest to another snow gully across which steps had to be cut. At last we got down to the bed

of the torrent, here flowing in the narrowest throat of the gorge between the far projecting southern curtain of Nanda Ghungti and the slightly less precipitous northern spur of Chandani Sankar. Ahead of us we saw a distinctly snake-like moraine curling round the true right bank of the Silla Samudr glacier, which apparently blocks the head of the glen directly under the western foot of Trisul. Crossing the stream by a snow bridge we reached the crest of the moraine three hours after leaving our previous camp, which was about a mile distant. The snout of the glacier descends to about 11,500 feet: its face is fairly steep, and although the right lateral moraine is double, showing a former much greater breadth and thickness of the ice, no sign of active retreat is evident at the present time.

We now realized that the sources of the Nandakgini lay in a T-shaped valley. A partially glacier-filled glen flows due south from Nanda Ghungti: the valley filled by the Silla Samudr glacier descends towards the north between Chandani Sankar and the western face of Trisul; these unite at the western foot of Trisul, where the Nandakgini river starts on its westerly course. Our way lay up the northern glen, in the mouth of which we camped (about 12,000 feet), sending our Almora coolies back at once and keeping only the two Gurkhas and six Sherpas.

The next two days were spent by the Ruttledges in reconnoitring, while I made photography and the map an excuse for a much-needed rest. The Silla Samudr glacier seemed to be stationary, while those flowing south from Nanda Ghungti appear very shrunken and choked by morainic deposits, but were still so deeply covered with snow that it was impossible to define their snouts with certainty. My map is merely a rough sketch, based on the 1-inch G.T.S. sheet, with details filled in from photographs. Unfortunately there are no observed peaks south-west of Trisul, and we were much too close under the summit of that mountain even to be sure of identifying its actual summit. We afterwards obtained the names Chandani Sankar and Yogi ki Kothi for the two most prominent outliers of Trisul on the south-west; but neither had been intersected, though both can be recognized on the G.T.S. 1-inch sheet.

The peak which is locally known as Nanda Ghungti is the Nandakna (20,700 feet) of the G.T.S. Synoptical, vol 35, p. 345, and chart No. 53N, but shown without name or altitude on the 1-inch sheet: Burrard and Hayden (pp. 6, 19) refer to it as $\frac{\text{Pk}76}{53\text{N}}$ Nandakna 20,700 feet. I have not ventured to alter this nomenclature, but have left the name Nanda Ghungti attached to peak 21,286, which is 2 miles due north of "Nandakna," as on my old map published in the *G.J.* 31, 372. Yet it seems certain that as the northern peak is invisible from the south, it is this southern peak which is the Nanda Ghungti of the people; also

I suspect that Nandakna is merely an alternative or a corruption of Nandakgini, the name of the river.

From a little south of the summit of Trisul a great buttress juts out westward. This soon curves toward the north-west and rapidly decreases in height. This jagged north-west buttress supports on its northern face a vast shelf of glacier which, descending on to the Rinti glacier, ultimately discharges into the Rishi valley on the north. But in one place this great northern shelf-glacier overflows through a slight depression in this steep north-west buttress of Trisul, and discharges south-westward to feed the Nandakgini river, which we have been following. Just north of this western overflow glacier there is an obvious passage up a 1000-foot gully to the top of this north-west buttress of Trisul, and which would lead straight on to the high shelf-glacier on the north face of Trisul. It is therefore a potential pass across the local water-parting. But the lowest depression in the Nanda Ghungti–Trisul ridge lies farther north, at the head of the glen we had entered. Here steep but easy snow-slopes (May 24) led up to a perfect snow-saddle, which is the obvious pass over to the Rinti glacier on the northern side of the range. For this we suggest the name Rinti Saddle : as it has never been crossed it should not be called a pass. Its height is about 17,000 feet. My Watkin aneroid was out of order, and we had to depend on a small but good aneroid which Ruttledge had brought. We got our height all the way from Satol by registering the differences from camp to camp both going and returning. By this means we were able to put our highest camp at 15,200 feet : the Rinti Saddle is about 1800 feet above this. It is obvious however that all the altitudes determined by us are mere approximations.

On May 23 we took a still lighter outfit and ten days' food up to a camp at about 15,200 feet on the highest moraine outcrop of the eastern-most of the two Nanda Ghungti glaciers. The site was most exposed, but conveniently close under the lowest snowy gap (our Rinti Saddle) in the ridge between Trisul and Nanda Ghungti. The Sherpas despise tents, and made a far better camp than ours under a big boulder on the moraine. We suffered daily from hail or snow-storms accompanied by thunder or high winds. Such weather made the condition of steep snow-slopes dangerous. On May 24 we reached the Rinti Saddle in three hours' easy going up steep and rather soft snow-slopes. New avalanches were lying at the foot of the still steeper slopes on both sides of us, as we approached the pass. Just south of the pass is a curious depressed hollow basin, giving the impression of local subsidence. From the crest of the pass we had a splendid view down on to the head of the Rinti glacier, which was very heavily snow-covered and disappeared to the north-west, flowing between Nanda Ghungti (21,286 feet) and the long precipitous northern spur of Trisul which terminates in peak 20,842 feet. A portion of the south-west ridge and the glorious summit of Dunagiri (23,184 feet) was visible over the north-west ridge of peak 20,842 feet

on the far side of the Rishi valley, giving us a very welcome check on our position. But the saddle on which we stood was heavily corniced, and at our feet snow-slopes, which we knew must be dangerous, fell away steeply for about 2000 feet to the head of the Rinti glacier. In my opinion it would be quite possible to make the descent on the north in good snow conditions; but the passage would demand much time and great care to effect safely. To reascend the pass from the north would be easier, but would take the best part of a day. If the slope was ice, then neither ascent nor descent would be practicable.

Since that part of the Rishi gorge into which the Rinti *nala* debouches has never been traversed, it was probable that we should have to return by the same route. We regretfully gave it up. But we were all three set on breaking through this redoubtable barrier. If we slept only one night on the Rinti glacier we could claim an absolutely new pass to our credit! As we looked back up to the summit of Trisul, ascended just twenty years ago, and still the highest peak whose complete ascent is undisputed, we realized that, if the snow would hold, it would be a simple matter to traverse left-handed from our Saddle and so gain the crest of the serrated north-west spur running down from Trisul, and look over on to the great shelf-glacier which drapes its north-western face. An hour's cautious traversing brought us to the crest, and to our great surprise we found ourselves only a few feet above the level of the shelf-glacier, which farther towards Trisul overflows through a gap in the ridge in steep icefalls over on to the south-west or Nandakgini side. The first part of the descent on the north side was apparently very easy, though not without danger from seracs falling from a smaller shelf-glacier higher up on the north-west face of Trisul. We could not see the actual junction of our shelf glacier with the main ice-stream of the Rinti glacier itself, but decided that this alternative route was well worth trying, and that we would take over enough outfit to enable us to sleep on the Rinti glacier and then return by the same route. By now the snow was in pretty bad condition, and the descent of the steep slopes back to our camp was not without moments of anxiety.

Our good fortune now deserted us—or the gods were angry. On May 25 we had a bad storm which continued all night and blew down the Ruttledges' little tent. Next day of course climbing conditions were impossible, and in the evening the cliffs of Nanda Ghungti and Trisul stood out ominously clear. On May 27 we left camp in desperation at 6 a.m., we three lightly and the two splendid Sherpas, Chettan and Lewa, heavily laden. We meant to rush the passage and go at least far enough to see the actual junction of the shelf-glacier with the Rinti glacier, returning in our old steps the same night. We dare not be caught on the far side of the pass by another of these pre-monsoon snow-falls. We had chosen the next *couloir* on the north to that by which the great shelf-glacier sent down an overflow tongue above our camp. We made

the first 1000 feet quickly and found the snow in the lower part of the *couloir* fairly safe : the way was clear to the crest of the ridge, little more than an hour above us. But for some time we had been alarmed by the look of the weather in the west, and it was now evident that we were in for a very heavy snowstorm. We turned tail as it commenced. We had a bad day in camp and a worse night. There were 9 inches of fresh snow next morning, and as it was still snowing and our gully would be impossible for several days, we struck camp and descended. Snow had fallen at our lower camp (12,000 feet) and the Whymper tent was blown down. The hot days made the new snow dangerous, and we deemed it wise to shift our camp out of this narrow side glen and on to a safer site under the cover of the " Snake Moraine " beside the snout of the Silla Samudr glacier ; it was also drier and warmer. Our caution was justified, for as we left this camp on the morning of May 30 we were enveloped in the snow-dust and rushing wind caused by an invisible avalanche, which I think must have fallen very near our former camp.

Instead of returning to Satol down the gorge of the Nandakgini, we spent five unforgettable days traversing the Chandani Sankar–Dagwal ridge, camping first at the upper limit of the birch forest and then at the upper limit of the fir belt ; halcyon days of ravishing beauty, with the great peaks of Nanda Ghungti and Trisul floating serene above the deep forest-filled ravine of the Nandakgini. Picking up more supplies at Satol, we despatched our baggage to Gwaldam by the Wan pass and struck out ourselves across the great outlying ridge south-west of Trisul over the Kailwa-banaik (about 12,500 feet) and Kurumtoli to Balan, the highest village in the valley of the Kailgunga, and so along the Nauali ridge down into the valley of the Pindar.

It is a grand bit of country, seldom visited because of the difficulties of supplies, but Ruttledge's *bandobast*, and the endurance of our Sherpas and the two Gurkhas, proved equal to every emergency. Day after day we wandered along high bare grassy ridges with beneath us incredible glens clothed in forest growing at the steepest angle ; and always with the snows to look up to, ever changing but ever beautiful. I have to thank my two companions for giving me a pilgrimage more care-free and more full of delight than any other I have made in Himachal.

DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said : This evening we are to spend in the High Himalaya, and our guide is to be Dr. Longstaff. Those who are Fellows of our Society need no introduction to Dr. Longstaff, but there may be those who are not Fellows in this hall, and I should say that Dr. Longstaff is an intrepid mountaineer who has climbed in three continents : in the Alps and the Caucasus, in the Himalaya, and in the Rockies. He reached the summit of Trisul. He has made two journeys to Spitsbergen, and he was a member of the 1922 Expedition to Mount Everest. With those credentials you may be quite sure that we shall have a very interesting account of the problem of Nanda Devi. I ask Dr. Longstaff to give his account.

Dr. Longstaff then read the paper printed above, and gave some account of the papers by Mr. Ruttledge and Col. Commdt. Wilson which follow; and a discussion ensued.

General WAUCHOPE: I have for many years been indebted to Dr. Longstaff. When he first met me, somewhere in the Himalaya, he advised me to visit the district of Trisul, and the vivid picture he has drawn of these mountains has laid me and all of us under a deep debt of obligation. I sometimes think that my friend Dr. Longstaff, who is a man of science, divides mankind into two classes: those fortunate mortals who have visited Trisul, and those less fortunate beings who have not had that privilege. But, speaking as a soldier, I cannot agree. I divide mankind into three classes: those who have never seen Trisul; secondly, those poor creatures, like myself, feeble, fearful, and infirm, who have had the privilege of visiting Trisul but have never succeeded in reaching its peak; and the third class, which is numerically very small—I rather think it is confined to one individual—contains those who have been to Trisul, solved its problem, and gained its summit.

Dr. Longstaff gave us such a vivid picture of these incomparable mountains that it would be an impertinence on my part if I were to attempt to add anything to what he has said, but I would like to make a couple of comparisons. There are many people who would of all buildings in India give first place to the Taj Mahal. They say while the other buildings are greater in size and may have greater grandeur, no building combines such lightness and strength, such perfection of setting, and such simplicity of design and beauty of ornament. I do not happen to agree. But I think that the argument used as regards the Taj Mahal may be applied, with far greater force and justice, to Trisul and Nanda Devi. I well remember when I first visited that country, fourteen years ago, it was in the month of May. The steep sides of the deep valleys were covered with dark green woods and bright green pastures. The valleys between them were all gold and yellow with ripening corn; the streams half hidden with wild roses and jasmine; among the pomegranate, bohinias, and other trees, all in full flower, were birds, mostly Asiatic, whose brilliant colouring I shall never forget; and higher up one came to those woods of rhododendron that Dr. Longstaff showed in one photograph, like Joseph's coat a mass of many colours. Farther up, far above the haunts of the animals and birds I had been shooting, one gained an incomparable view of the serene beauty of Trisul and Nanda Devi. I have never seen any view which inspired me with feelings of such reverence and awe. Sometimes I think that when we climb 10,000 or 20,000 feet above sea-level it is not only our bodies we raise to that height. I believe it happens sometimes that our minds are also uplifted to a higher plane. You may remember when Victor Hugo is discussing the great poets of the world he says of Shakespeare in a fine phrase that Shakespeare is a promontory into the infinite; a promontory along which we poor mortals may clamber and climb and gain a vision of things that are ordinarily hid from our mortal eyes. When first I looked upon that marvellous vision of Nanda Devi and Trisul, I felt that they well deserved the words of Victor Hugo, and may well be termed "Headlands into the Infinite." It is for recalling that vision to us to-night, and for his brilliant exposition of these mountains, that we have to thank Dr. Longstaff.

Brig.-Gen. Hon. C. G. BRUCE: I cannot speak without first referring to the recent loss of our companion, Arnold Louis Mumm, and I must also remind you that that particular expedition to which Dr. Longstaff has referred, to the

north side of the Nanda Devi range, was a secondary thought; that we had almost arranged for the first exploration of Mount Everest. The expedition had been financed and was ready to start entirely through the generosity of Dr. Longstaff and Mr. Mumm. It was only owing to political difficulties that it was found necessary to switch off to a further exploration of Dr. Longstaff's own particular stamping ground, so to speak, the Nanda Devi range. We had on that occasion the full support of the Viceroy, then Lord Minto. Without his help it would have been extremely difficult for us to have fitted out an expedition on the lines of that which we took into Garhwal, itself an extraordinarily bare country.

Dr. Longstaff has not quite brought out what an exploration of Nanda Devi means, because he is a great deal too modest. I must let you into the secret. When we made our great attempt to explore the Rishi valley it was impossible, from the point of view of cold, of outfit, kit, and possibly capacity, to take with us local men. We had to follow up the glacier which lies to the north of the group, the great Bagini glacier, fairly early in the year (in May, in fact) and be prepared to cut ourselves off from all help for ten days—tents, cooking apparatus, even some spirit for fear we should not find wood, food for two of the hungriest guides I have ever seen, besides being the strongest, for four very hungry and strong Gurkhas, for Dr. Longstaff, and for, no bad trencherman, myself. Dr. Longstaff and I had a very formidable rifle each and adequate ammunition to carry also. We camped with our full loads up on Bagini glacier at a height of 18,000 feet. From there we had to go with our packs on our backs over the Bagini Pass, 20,100 feet, the climb to the pass requiring a great deal of step-cutting on the part of the Brocherels. That was the easy part. Then we had to go down that steep cliff shown in the slide, needing 500 feet of rope. That was a real teaser with our heavy loads. I remember that particularly because the heaviest load of all was carried by Alexis Brocherel, who had elected to come down last. Just before I had started he asked me to exchange loads. I had his load in addition to my rifle, and the remarks I made are not recorded except by Dr. Longstaff . We had a very rough time, but eventually landed on the Arhamani glacier and had to follow it down for some miles. The last to come down were Dr. Longstaff and myself. In one place we had to sling ourselves down on about 60 feet of rope with our loads. Dr. Longstaff shot burhel, and it will give you some idea of the difficulty encountered in the Rishi valley if I tell you that we were never able to get back to our cache of burhel meat when we made a second advance up the valley. On the second advance we were camped at the junction where we could see that extraordinarily difficult side valley which leads to the foot of Nanda Devi itself and the way up to Trisul, and from there Dr. Longstaff with his companions made the ascent of Trisul, which still remains to this day the highest actual summit yet reached by any human being. There they had an experience which has stood us very well indeed since. They were camp-bound at 20,000 feet in a real blizzard, and there they thoroughly understood what a blizzard means when continued for two nights and a day at that altitude. Every one had to come down for the purpose of food and rest exactly in the same way as the Mount Everest Expedition in 1924. Over that height a real storm will take it out of you quite as much as a very hard day's work.

Dr. Longstaff in the pluckiest possible way went out this last year to continue his explorations, and I think it is a matter of very great congratulation that he was able to do so. We have now at any rate in Kumaon a most sympathetic Deputy Commissioner, and there is no doubt that he will continue the explora-

tions of this splendid group. There is a little still to be learned, but there is an enormous amount still to be done of what we might call minor exploration in the rest of the range.

I think I am right in saying that in Garhwal, within an area equal to Glamorgan and half Monmouth, there are no less than eighty peaks over 20,000 feet. To the north also lies another field, well known in mountaineering history, Kamet and Ibi Gamin. Attempts have been made on both of them, and they have been explored by Dr. Longstaff himself. There is still in the same neighbourhood a little exploration to be done, too, in connection with the source of the Alaknanda. It looks a comparatively simple geographical problem; the mountaineering difficulties are not known. We hope some day some one will tackle it and be able to push his way up the Sathepanth glacier and over to the other side and descend near Gangotri somewhere and complete the circle of the source of the Ganges.

It may interest you to know that the companions who chiefly accompanied Dr. Longstaff, not only on his first attempt on Trisul but also on his subsequent explorations on the southern face up the unknown valley of Sonadhunga, were two Gurkhas, one of whom got the M.C. in the war, retiring desperately wounded; the other retired with the honorary rank of captain, both going about as far as they could under the circumstances. Of course his Gurkha companion on the ascent of Trisul was the well-known sub. Karbir, who had travelled so much with Sir Martin Conway. It is also interesting to me that a certain number of Sherpas from Darjeeling took part in the last exploration, with Mr. Ruttledge and Dr. Somervell. They are first-class people, but I must point out that in the neighbourhood of Milam among the Milamwals and also among the Dhanpurias there are men who would do equally good work if they had the opportunity of training that the Sherpas have had. A certain number of the Dhanpurias, I believe, have enlisted in the Garhwal Rifles and have done first-class work. That is a source which might easily be tapped to help other explorers to push their way into that part of the world and save the expense of importing men, besides which it would give a great stimulus to local activities.

Col. E. F. NORTON: I should like to add my tribute to Dr. Longstaff for his fascinating lecture. Widely as Dr. Longstaff has travelled and widely as he has climbed, he has told us to-night about the country which he has made peculiarly his own and of which he can speak with an authority which nobody else can claim. In those halcyon days before the war I spent seven years on the banks of the Ganges, and thence on rare occasions, when a shower of rain cleared away the dust haze, about 150 miles away along the northern horizon like a picture thrown on a screen, we used sometimes to see that great outer range of the Himalayas—a wonderful panorama, with those two great mountains, Nanda Devi and Trisul, the central figures. In those days we, having eyes to see, saw not. We concentrated our activities entirely on three other pursuits: we used to spear the grey boar; we used to shoot tiger and other big game in the foothills and in the jungles of the Central Province; and if we wanted a change of air we used to go to the Himalaya and shoot sheep and goats, and the Kashmir stag. I am wrong: we had a fourth pursuit. We used to do a little soldiering in our spare time. I for one, when I got leave to Europe, used to spend every week of it in the Alps. Yet we never dreamed of attempting the giants of the Himalayas. We little knew that on one of those very days on which we could see those great peaks to the north of us, perhaps at that very time, an Englishman was reaching the top of one

of them and thus constituting a world's record for the highest peak that has ever been climbed.

Later, when I became associated with the Mount Everest Expeditions, I foresaw that they might lead to a recognition among Englishmen in India of the possibility of the Himalaya as a playground from the Alpine point of view; and from what we hear of the two new mountain clubs which they are starting in India it looks as if my hopes may be fulfilled. If it was the Mount Everest Expedition which directed the attention of Englishmen in India to the mountaineering aspect of the Himalaya, it was the enterprise of men like General Bruce and Dr. Longstaff which demonstrated what could be done with a small bundobust, which showed the way to what a poor man with limited resources of time and money could achieve. I think this movement is undoubtedly going to gain ground in India, and when it does the pioneers will gain that tardy recognition which is the reward of those who do not broadcast their achievements in books but, like Brer Rabbit, "lie low and say nuffin'."

The PRESIDENT: We are very glad to hear from Col. Norton that two mountain clubs have been formed in India. No doubt one of these days they will amalgamate. The formation of a mountain club is a thing that ought to have taken place long ago, but we are glad to hear that it is now being carried out. We are sure that if they do start they will have a very long and successful career. Dr. Longstaff this evening has said very little about himself, but I think that we should remember his record for the highest summit, made on Trisul many years ago, remains unbroken. We have not now the means, or the opportunity, of celebrating his exploits in the Bhotia manner, but in your name I am sure I shall be right in thanking him for his lecture and for the very admirable slides which he showed us, which did, in some small way, convey to us the majesty of the Himalaya. We also thank Mr. Ruttledge, who provided many of the photographs and some of the information, and Colonel Commandant Wilson, for their contributions to this evening's meeting.

Phot. Mr. H. Ruttledge

Nanda Devi from 14,350 *feet on Qalganga Ka Pahar*

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Phot. Mr. H. Ruttledge

West shoulder of Nanda Kot from Névé of Pindari glacier

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NOTES ON A VISIT TO WESTERN TIBET IN 1926

HUGH RUTTLEDGE, I.C.S.

THE traveller wishing to enter Tibet from the Almora district of the United Provinces has before him a choice of three main routes. The first goes by the valleys of the Sarju and Goriganga to Milam, a distance from Almora of 110 miles, and thence over the Untadhura, Jainti, and Kingribingri passes to the Tibetan market at Gyanima, some five marches from Milam. The other two routes are identical with each other as far as Khela, in the valley of the Kali river, our frontier against Nepal; from this place the Darma valley branches off to the north, past the lovely Panch Chulha peak, and at its head lies the Nuë, or Darma pass, leading direct to Gyanima. The other, and easier, route is up the Kali valley *viâ* Garbyang to the Lipu Lek pass, within easy reach of the big market at Taklakot. On this route is encountered the famous, or rather notorious, Nirpania cliff, the worst part of which can now be turned by a *détour* along the Nepalese bank of the river.

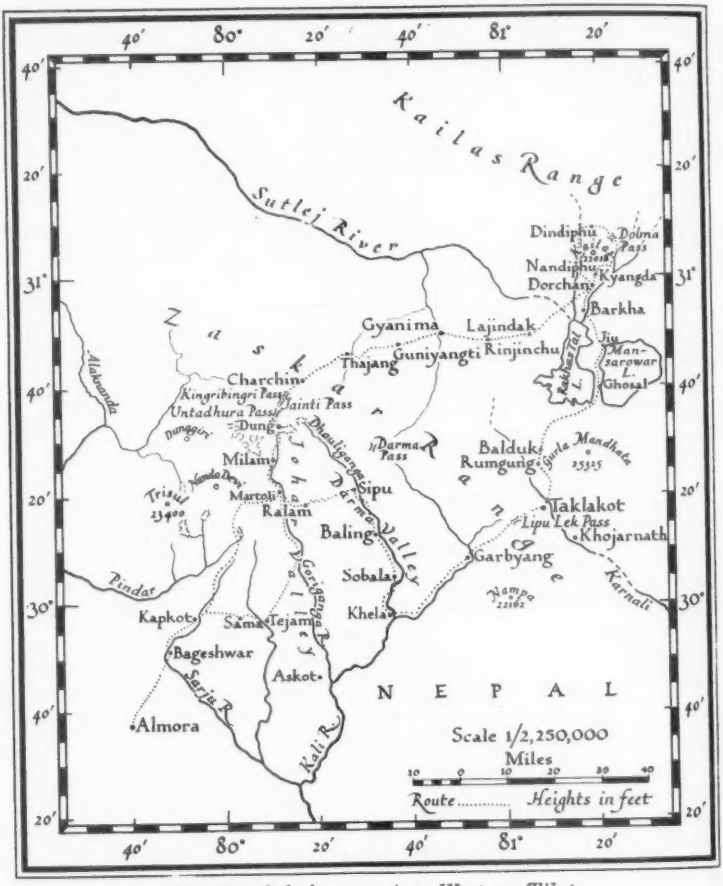
The valleys above named pierce the central chain of the Himalaya, and are the home of the Bhotias, a people probably of Tibetan origin, though now professing the Hindu religion. They have a monopoly of the trade between India and Western Tibet, a monopoly of which no one is likely to deprive them while communications remain in their present state.

Undoubtedly the easiest of the passes is the Lipu Lek, 16,750 feet high. This can be crossed by mules and ponies eight months in the year; but it should not be treated with contempt, for I know a Bhotia who lost his toes on it in November, three or four years ago. The Bhotias of Chaudans and Byans, the northern pattis of the Kali valley, usually cross into Tibet in July and return in October. Taklakot is about 7 miles across the border.

Under orders from the Government of India, I visited Western Tibet in 1926 to investigate conditions of trade between the Tibetans and the Bhotias. The latter carry up every year grain, rice, cloth, and various kinds of haberdashery, returning with wool, borax, and salt. But for them Western Tibet would probably starve, as the high altitude of most of the plateau, and the nomadic habits of the people, render cultivation impossible.

Before the British expedition to Lhasa in 1904 no officers had, so far as I know, visited this part of the country on duty. But in 1905 Mr. C. A. Sherring, of the Indian Civil Service, was deputed to report on trade and to cultivate friendly relations with the officials. He described his experiences in 'Western Tibet and the British Borderland.' He was followed, in 1908 and 1911 respectively, by Messrs. Cassels and Stiffe, of the same Service, acting under similar orders. Since then a number of complaints from Bhotias concerning trade restrictions had accumulated, and it was thought desirable to have them inquired into.

I was fortunate in obtaining permission to be accompanied by my wife and by Colonel Commandant R. C. Wilson, D.S.O., M.C., Indian Army; and after some preliminary work in the Johar and Darma valleys—the latter being reached by way of the Rálam pass—we crossed the Lipu Lek on July 10 and pitched camp at Taklakot. I need not



Mr. Ruttledge's route into Western Tibet

add anything to the descriptions of this part of the country published by Dr. T. G. Longstaff and Mr. Sherring. A violent wind, blowing unexpectedly from the east, expedited the pitching of tents, and we settled down to four days of official calls, interviews, and business discussions. The place of the Jongpen, who was away at Lhasa, was more than adequately supplied by his wife, a lady of determination and much business

acumen. We had the good fortune to witness, in the monastery, the "Gugu" ceremony, or spring blessing of the people. This was extremely well arranged and conducted by the chief lama, who is appointed from Lhasa. His dignified courtesy provided a pleasant contrast to the manner of his monks, who appear to be turbulent and ill-disciplined.

Some light was shed on local politics by a strike of the local villagers, who have to provide forced labour to the Jongpen and the monastery. The lady incumbent was quite equal to the occasion; she called in the Church, and as the lay and ghostly authorities of the place thoroughly understand one another, the strike collapsed.

News was received here that the newly appointed Senior Garpon, or "Viceroy," was on his way from Lhasa to Gartok. He would pass through Barkha, north of the sacred lakes, and this afforded the hoped-for opportunity to continue our journey northwards, instead of making straight for Gyanima, as an interview with the great man was highly desirable. Accordingly, on July 16 we left Taklakot, turned the eastern end of the ridge, passed the Jumla mart of Gungung Samba, and faced north. For some 3 miles the going was fairly level, but after passing the tomb of Zorawar Singh, the Sikh general who was defeated and killed here in 1841, we found ourselves breasting a long and steady ascent. To the left was the valley of the Karnali river, flanked on its farther side by low hills, and the road to Gyanima; to the right were the endless scree slopes up which Dr. Longstaff forced his way in 1905, in his attempt on Gurla Mandhata. The great mountain was fairly free from cloud, but a good view of it is not obtained till one reaches the neighbourhood of the lakes.

Up to this point there had still been a fair amount of cultivation to be seen, with here and there a house, and even a poplar tree; now, however, the road with its frequent "manis" struck boldly into the wilds, and as if to mark the change we met a picturesque mounted ruffian from the region north of Kailas. One of our Bhotia companions explained that he was an amateur dacoit. Evidently he was out of practice, for he smiled blandly, showed me his sword in its silver scabbard studded with turquoises, and posed for the camera.

We were now at a height of nearly 15,000 feet, and traversing a bare and stony wilderness studded with burtsa and scarred by occasional rocky watercourses. Towards midday the wind got up, and the sun was very powerful, while water was absent till we reached Rumgung, where is a small river flowing westwards from Gurla, past a little monastery. This is a fairly good camping-place, partially sheltered from the wind by a few stone walls and by the banks of the river; it is infinitely preferable to the bleak and inhospitable Balduk, a short distance farther on.

By the evening of July 17 we were encamped at the south-east corner of Rakhas Tal, after crossing a col of about 16,000 feet to the west of the Gurla pass. From the col there is a magnificent distant view of Kailas;

in the middle distance lie the blue waters of Rakhas, studded with a few islands and bounded by low hills which are a riot of red and brown and green. A strong and steady west wind was driving the waters of the lake in little waves against the south-eastern shore ; and here we met a party of three Dokpas, on their way to Taklakot with sheep. They were armed with the muzzle-loader of the country, with the usual forked rest attached to the muzzle, and a beautiful tassel pendent from the latter. The breech was carefully protected from the driving sand by a parti-coloured cloth. Swords in scabbards bright with silver incrustations and turquoises completed their armament.

The water of the lake is sweet. On one of the islands near the southern shore is said to reside, wrapped in contemplation, a sadhu from Muttra, to whom a year's supply of food is taken across the winter ice. In the previous winter the ice gave way beneath the provision party and they were drowned ; my informants could not say whether any further attempt was made to reach the unfortunate hermit. The Hindus of the party appeared to have scant veneration for Rakhas.

On the morning of July 18 we crossed the neck of land which separates Rakhas from Mansarowar, a distance of only $3\frac{1}{2}$ miles, to Ghosal Gumba. The elevation of this part of the neck is some 300 feet above the lakes. It is well covered with burtsa, and abounded in upland hares (*Lepidus hispidus*) and a kind of field rat, all very tame.

The water of Mansarowar also is sweet. The Hindus, and even one or two of the Bhotias, occupied themselves with a highly superficial ceremonial bathe ; I attempted a swim, but was forced by the cold of the water to come out very soon. However, I was pronounced to have acquired merit by the performance.

At this place we saw no birds, but in the course of next day's march to Jiu, partly along the shores of the lake, we saw a fair number of bar-headed goose (*Anser indicus*) and Brahminy duck (*Casarca rutila*). Sand grouse (*Syrraptes tibetanus*) were plentiful among the low hills. About 3 miles short of Jiu lies a large borax bed, now in disuse. Since the War the export of borax has declined very rapidly.

Jiu monastery is built on an isolated rock, about 100 feet above the shore ; it is a foundation much favoured by the Dokpas, and must be one of the dirtiest in Tibet. It overlooks a well-defined channel running westwards from Mansarowar to Rakhas. We found a little sandbar, about 3 feet high, keeping out the waters of the former ; but it seemed likely that water had recently flowed, as there was a chain of pools which, to the west of the monastery where there are some hot springs, merged into continuous water. The latter did not appear, at the time, to be in motion ; the Bhotias and Tibetan yak-drivers, however, assured me that they had seen water actually flowing from Mansarowar to Rakhas, three or four times in the last ten years ; and that in 1925 it was necessary to wade through it at Jiu. I satisfied myself, by the

aneroid, that there is a difference of some 50 feet in the altitude of the two lakes, Mansarowar being of course the higher. Heavy rain, which does sometimes occur in this region, might easily break down the little sandbar. Next day we crossed a channel about 20 yards broad, coming down from the hills to the north-east. It enters the first channel just west of Jiu, and undoubtedly carries water when the snow is melting or after heavy rain. The west wind was terrible at Jiu, coming up-channel rom Rakhas, and it lasted nearly all night.

The road, or rather series of tracks produced by the habit of yaks to advance across country in line, now turned off north-west, towards Barkha; and we entered a region, first of low sandhills covered with burtsa, and then of open plain, one of the great grazing-grounds of this area. At the northern edge of this plain rise suddenly the lower buttresses of Kailas. Barkha itself is by no means easy to find, as it lies under a bank, and is invisible till one is right on top of it. In any case there is not much to see, this headquarters of the Barkha Tarjum consisting of two mud houses and a courtyard. Here the post from Lhasa to Gartok changes, and the Government trader stacks his China tea, of which he will afterwards dispose by forced sales to the people, while he lays in merit by visits to Mansarowar or Kailas.

Whatever the defects of Barkha architecture, there are none in its views. To the north Kailas, alone and unrivalled, the perfect shiwala; to the south the gigantic ramparts of Gurla Mandhata; and far beyond them, yet visible in this clear atmosphere, the Himalaya. East and west stretches the illimitable grass plain, dotted with sheep and yaks, occasional black dots showing where the Dokpas and Nekarias are encamped.

Fortune smiled on us here; the Garpon was not expected for five or six days. Obviously, therefore, the moment was ripe for a pilgrimage round Kailas, and this began on July 21 with a march to Dorchan, where the "parikarma" route branches off to the west for the orthodox clockwise circuit of the mountain. Dorchan is a Bhotanese foundation, entirely free from Tibetan interference.

The place was full of interesting types: nomads from the north, one of them a smartly dressed youth armed with an old but well-kept Russian Army rifle, and accompanied by an equally smart wife whose fur toque was the admiration of us all; pilgrims from Kham on the Chinese frontier; big hulking Nekarias, soi-disant traders, but obviously of doubtful respectability; beggars of every description; and three devoted Hindus from the Central and United Provinces, recently robbed, and miserably cold and underfed, requiring assistance. One cheerful party of Tibetans was busily engaged in performing the parikarma, a distance of 28 miles, once a day for twelve consecutive days, thereby acquiring sufficient merit to last a lifetime. The altitude of Dorchan is about 15,200 feet.

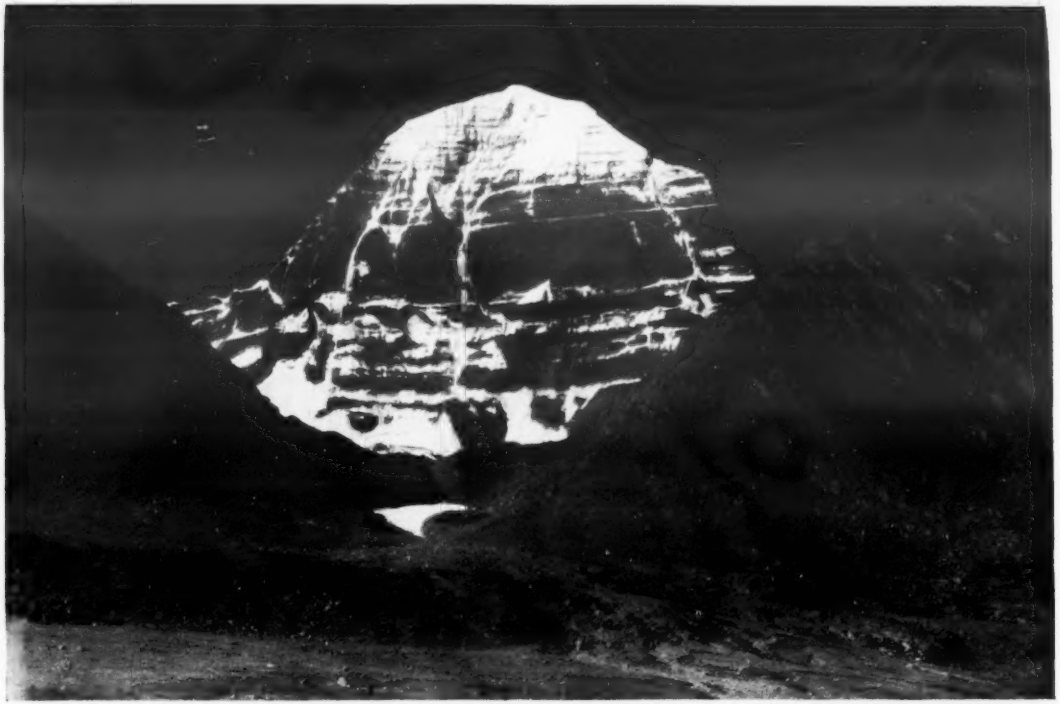
Leaving at 7 a.m. on July 22, our main party set off westwards along

the well-worn track, marked every few yards by manis and chortens which have to be passed on the left. Colonel Wilson and a Sherpa porter struck off up the nearest valley, bent on an exploration of the approaches to the mountain, while we continued westwards for about 3 miles, and then turned north to gain the western flank, up a gaunt and awe-inspiring valley, the true left side of which is formed by the terrific limestone precipices of Kailas. Some 3 miles up this valley lies the little Nandiphu monastery, with a staff of three men and one woman; and close by are a few caves in which hermits are walled up for prolonged meditation. It is a grim spot, but the staff were friendly and cheerful, and showed us their images and library with pride. The deputy chief, whose superior was away at Khojarnath, took particular pains to display one fierce-looking image, explaining that as police were few in the country it was necessary to guard against thieves by more ghostly means. This monastery also is a Bhotanese endowment.

Soon after leaving this place we were assailed by a storm of hail and sleet, but soon the white summit of Kailas was again visible through a cleft in the limestone curtain; one of the wildest rifts it has ever been my luck to see. The rocks on this side drop sheer into the valley for thousands of feet; gigantic slabs, showing almost no trace of weathering. Somehow or other, Colonel Wilson and his Sherpa companion found their way down faults in this face, and to our great relief rejoined us at Dindiphu monastery, on the north side of the mountain, in the evening. Theirs was a fine bit of mountaineering.

The little Dindiphu monastery is a Lhasa foundation; it lies in a desolate wind-swept valley, at a height of a little over 16,000 feet. To the north are the lower ridges of the Kailas range, some 18,000 feet high, mere rubbish heaps of loose limestone, with patches of snow in the gullies. Southward there is only one thing to see—the immense north face of Kailas, a precipice of about 6000 feet, utterly unclimbable. Near the summit (22,028 feet) there is some ice and snow, the whole crowned by a big cornice; but for the most part this face is of perpendicular limestone slabs, of a brown and chocolate colour, far too steep to hold snow, and entirely unbroken.

Next morning, July 23, broke fine, and we left at about 8.30 to climb the 2000 odd feet which lead up to the sacred "Gauri Khund," a frozen lake at the end of the long north-east ridge of Kailas. The Hindus went fasting, and felt the altitude a good deal, though the ascent is gradual and nowhere difficult. By 11.15 we were all at the Dolma pass (18,600 feet). Here is an enormous boulder, gay with flags and streamers, round which both Hindus and Bhotias went in solemn procession, murmuring prayers. I estimated the area of the lake to be, roughly, 7 acres; it was frozen over except at the sides, where the hot sun had melted it a little, and ceremonial bathing, mostly symbolic, was possible. Here I was surprised to see a solitary bee.



Phot. Mr. H. Ruttledge

North face of Kailas from Dindiphu

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Phot. Col. Commdt. R. C. Wilson

Jiu Monastery

Phot. Col. Commdt. R. C. Wilson

The Darma Gorge from near Nangling

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From this point the north-east ridge springs up steeply for 1000 feet or so, and then carries on at an easy angle for about 2 miles till it articulates with the north-eastern arête leading sharply to the summit. An ascent might be just possible by this route; but we made no attempt, as I was afraid of missing the Garpon, and also the weather did not look at all propitious. Before leaving, the Hindus and Bhotias enacted a pretty little ceremony: they insisted on sharing food with us, declaring that caste was in abeyance at this spot, and that this act would ensure our meeting in another life.

A steep descent, down execrable boulders and scree, led to a beautiful green valley watered by a river; a complete contrast to the savage grandeur of the western side. Unfortunately the clouds were now coming up fast, and we never got a view of the eastern side of the mountain; but the general impression was that from this direction the angles are less severe, and that an ascent from the south-eastern corner should offer the best prospects of success. For the most part the permanent snow-line appears to be at about 19,000 feet. By evening we were encamped at the Jumtilphu monastery, another Bhotan foundation; and from here could again see the great plain of the lakes. Enormous herds of sheep were coming down from the north-east on their way to Gyanima.

On the morning of July 24, after a visit to the monastery, six of us abandoned the regular track, of which 6 miles remained to Dorchan, and struck up a valley westwards, hoping to see something of the mountain from this side. After some hours' scrambling we reached a watershed at about 18,000 feet, but were again disappointed, for though everything was clear towards the lakes, Kailas itself was wreathed in cloud. So we descended upon the Kyangda monastery, under the south face, and here found about a dozen monks, led by a little man, who appeared not too pleased by our visit, but showed us the interior, with its beautiful lacquer and brass work, and well-kept images. In a corner was a monk reading a manuscript, marking each sentence by beating a drum at his side. There was a suit of chain armour, said to be a relic of Zorawar Singh's army.

Returning to Dorchan, we found that the new Garpon had arrived, but had inaugurated his *régime* by setting off for the parikarma. So we had to wait for his return, in bad weather; and met him on the 28th. The interview with him was both interesting and pleasant; he is of a good Lhasa family, and has charming manners and quick perceptions.

The journey from Dorchan to Gyanima, *viâ* Lajindak and Rinjinchu, needs little description. At Lajindak we appeared to be encamped by the first continuous water of the Sutlej, though I think that Rakhas Tal, about 6 miles away, may be considered to be the source, as between stretched a long chain of pools. The water of the Sutlej was brackish and unpleasant.

The name Gyanima is applied to two markets, 4 miles apart, the summer headquarters of the Johar and Darma Bhotias. It is a well-watered plain, shut in to the north by hills, and terribly exposed to the west and east winds. No houses are permitted here, and hail and sleet storms appear to be frequent. Here we met the British Trade Agent and the Tibetan Government trader—the Jung-Chun—a most amusing and sagacious person, fully alive to the iniquities of his traffic.

Three days were now devoted to official calls and diplomatic discussions, and on August 3 we said good-bye to our Tibetan and Bhotia friends, and started for the three days' march to the Kingribingri pass, *viâ* Guniyangti and Thajang. Here, as everywhere else on these plains, almost the only vegetation seen, apart from the occasional grass, was the cushion-like *Caragana pygmæa*, for which name I am indebted to my friend Rai Shiv Ram Kashyap Sahib, Professor of Botany at the Government College, Lahore, an indefatigable traveller who accompanied us all the way from the Lipu. Here also we saw many kyang, mostly very tame.

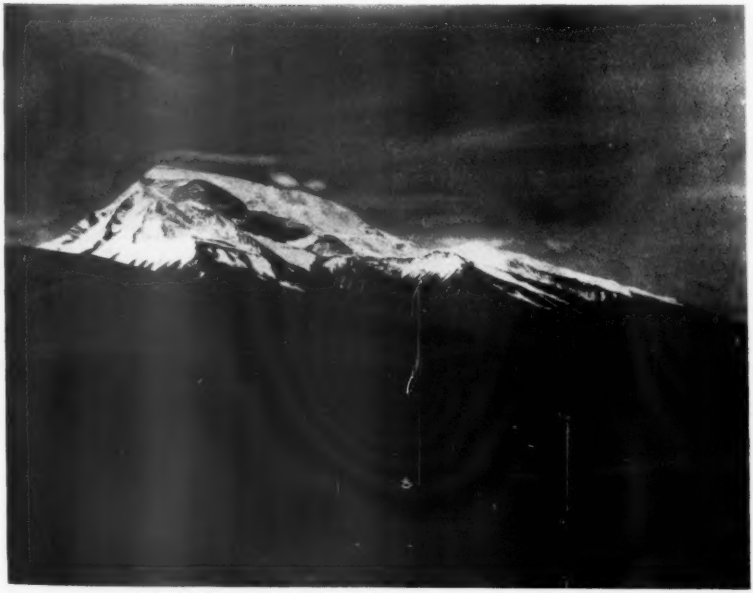
On the evening of August 5 we found ourselves held up by a little glacier river in spate, near Charchin at the foot of the Kingribingri; but by starting early next morning we were able to cross the icy water and accomplish the long march *viâ* the Kingribingri (18,300 feet), Jainti (18,500 feet), and Untadhura (17,700 feet) passes to Dung, near Milam. Near Charchin and on the top of the Kingribingri we found, for the first time, fossils in considerable quantities. They were mostly, I think, ammonites. The Rai Sahib had found one or two at Dorchan.

Colonel Wilson and my wife and I completed our return to civilization, accompanied by two Gurkhas and four Bhotias, *viâ* Martoli, the Lwanl Gadh and Traill's pass, last crossed in 1861 by Colonel Edmund Smyth. The pass has probably become more difficult since it was crossed in 1830 by Traill, owing to the retreat of the Pindari glacier, and is now only suitable for mountaineers.

Thus ended, at Almora, some 600 miles of enjoyable trekking, performed entirely on foot to the scandal of right-thinking Indians and Tibetans. Our little retinue appreciated, as much as we, the opportunity to visit Kailas, and for much of our pleasure we were indebted to the labours and companionship of Kunwar Kharag Singh Pal, a scion of the old Rajwar family of Askot, who in 1905 accompanied Dr. Longstaff and Mr. Sherring.

Phot. Mr. H. Ruttledge

Kailas from Barkha



Phot. Col. Commdt. R. C. Wilson

Gurla Mandhata from Manasarowar lake

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Phot. Mr. H. Ruttledge

Channel between Manasarowar and Rhakas from west side of Jin

NOTE ON THE CHANNEL CONNECTING THE LAKES MANASAROWAR AND RAKAS

COL. COOMMDT. R. C. WILSON, D.S.O., M.C., I.A.

ACCORDING to the map "India and Adjacent Countries," Sheet No. 62, 1/1,000,000, the altitude of Manasarowar is 14,900 and of Rakas 14,850. The channel joining the northern extremities of the lakes is some 2 miles in length.

I arrived at Jiu monastery (at the manasarowar entrance of the channel) on 19 July 1926. At this time of year the snow which feeds the lakes should have been in process of melting, and a certain amount of rain, the "overs" from the Indian Monsoon, should have been falling. The two lakes should therefore have been full, and one would have imagined that, if water ever flows from Manasarowar to Rakas, it would have been doing so. At the time of my visit, however, the channel was dry except for an occasional pool, and the entrance to the channel from Manasarowar was blocked by a bar of sand and shingle. To judge by the lines of debris on the shore of Manasarowar, that lake was falling rather than rising.

Among the party with whom I was were several prominent Bhotia merchants who had often visited the district and knew it well. I inquired of them as to the channel; they all said that it was unusually dry and that they habitually crossed it at Jiu monastery and were accustomed to wading it, the water being halfway up their thighs. They accounted for its present dry state by the late spring (the snow was not yet melting at its full rate) and the exceptional dryness of the year. The plain, they said, should have been covered with grass and the sheep well fed, whereas the plain was bare and the sheep thin.

It seems to me that this evidence of the Bhotias is conclusive on the point that the channel is usually flowing during the summer months. To disbelieve their evidence is to assume that they make a habit of wading a stream which can be crossed dryshod, as we crossed it, within a couple of hundred yards.

There are indeed other ways of accounting for the pools of water we found in the channel. One is that the channel has feeders other than the Manasarowar Lake; and another is that the water arrives there by seepage from the lake, underground. Both these conditions probably obtain; but the feeder depressions exist on the north bank only; they are too insignificant to merit the name of streams, drain a comparatively small catchment area, and would carry water to the channel only immediately after a heavy storm. Seepage undoubtedly exists.

In 1846 Capt. Henry Strachey said that the channel connecting the two lakes was 100 feet wide, 3 feet deep, and was flowing rapidly from east to west. Maybe it would require an unusually wet year to reproduce these conditions to-day, but in a normal year the water does undoubtedly flow. In 1926, at the time of our visit a rise in level of perhaps a couple

Channel between Manasarowar and Rhakas from west side of Jiu

of feet would have been sufficient to have caused Manasarowar to break through the bar and fill the channel.

Another interesting point in the drainage of these parts is the destination of the three main streams (east, west, and centre) flowing south from Kailas Parbat. According to the lie of the country the water of these three streams, which are of considerable size, should flow into Rakas or into the channel of the Sutlej west of Rakas. Actually I could see no signs that any of this water reached the lake above ground. The streams break up into many channels after leaving the foothills, and, within a few miles, have disappeared. The water must find its way into the lake and into the Sutlej, but does so underground.

The first signs of water we found in the Sutlej was about Lajindak, where the river enters the hills; here there was a small trickle. The porous character of the soil can hardly have changed, and one must either assume that the channel of the Sutlej leading out of Rakas was cut by flood water in unusually wet years or else that the rainfall of this part of the country has decreased in recent times.

Note by Dr. T. G. Longstaff.

I camped at the Mansarowar end of the channel on 30 July 1905 and found conditions very similar to those described above. The late Pandit Gobaria of Garbyang said that he had seen water flowing in the channel, directly from Mansarowar, "many years ago." My companion, Mr. C. A. Sherring, I.C.S., secured a good panoram of the whole channel, which is on view in the upper corridor at Lowther Lodge: this is reproduced in Sherring's 'Western Tibet' (Arnold, 1906) on p. 271: on pp. 284–5 are some remarks on the Sutlej channel from Rakas Tal. Granted that progressive aridity is taking place, very little change could be expected in twenty years; but since Henry Strachey's visit the change is considerable. It is to be hoped that future travellers will copy Col. Commandant Wilson's example both in making and recording their observations at this test point

THE PHYSICAL GEOGRAPHY OF SOUTH-EASTERN ARABIA: *A paper read at the Afternoon Meeting of the Society, 16 January 1928, by*

G. M. LEES

DURING the course of the past six years it has fallen to my lot to take part in, or to conduct, a series of expeditions in various countries on the fringes of Arabia. These include the Sudan Red Sea littoral, Transjordania, Syria, Mesopotamia, Persia, the Persian Gulf coasts, and lastly, in the winter 1925–26, 'Oman and the south-eastern Arabian coast as far as the province of Dhofar. Systematic exploration of the interior of Arabia, or indeed of its fringes, is greatly hampered by formidable natural barriers and by the still more serious obstacles caused by the independent spirit of its inhabitants. For the latter reason I must admit partial failure of my last expedition, but I was able to make a number of new observations which throw some light on old difficulties, although perhaps I have raised more new problems than I have disposed of old. I was unsuccessful in penetrating into the heart of the 'Oman ranges, the great Jabal al Akhdhar (or the Green Mountain), but I traversed a considerable extent of hitherto unexplored country farther to the north, crossing the mountain ranges six times in all.

The expedition consisted of Mr. K. Washington Gray and myself as geologists; Mr. Joseph Fernandez, an Indian botanist and collector; and Mr. A. F. Williamson, better known as Haji Abdulla Williamson, whose intimate knowledge of all things Arab, acquired during a thirty years' sojourn with the tribes, made him invaluable as our political agent. We were accompanied during part of our journey by Capt. G. J. Eccles, the officer commanding the Muscat State Levies, and during part by Mr. B. S. Thomas, the Financial Minister to the Sultan. Without the cordial assistance of these gentlemen our traverses into the interior would not have been possible. The preliminary arrangements for the expedition were made by Sir Arnold Wilson; thanks are due to him and to Sir John Cadman, and the Directors of the D'Arcy Exploration Co., Ltd., for permission to make public the geographical and geological results of the expedition.

'Oman has been the subject of a series of papers to this Society during recent years, notably by Col. S. B. Miles (1, 2 of the Bibliography at end of paper) and by Sir Percy Cox (3, 4); and Capt. Eccles has already lectured to the Central Asian Society on the more human aspect of our journey. I propose, therefore, to confine my attention more to the physical geography and geological tectonics of the country, adding as appendices some disconnected notes dealing with Bahrein and Qatar, and reports on flint implements, birds and insects collected. The botanical collection was presented to the Bombay Natural History Society, by whom it is being examined.

Geologically Arabia, including the Syrian desert as an integral part of it, is considered to form a great single massif lying between the folded mountain ranges of Persia, the Zagros System, on the north and north-east; the anti-Lebanon, likewise a folded system, on the north; and the rift-valleys of the Dead Sea, Wadi el 'Araba, and of the Red Sea on the west and south-west. The south and south-eastern coast is ragged and appears to lack a definite system in its construction.

Within these limits the monotony of the topography reflects the simplicity of the geological structure, that is considering only for the moment the Mesozoic-Tertiary mountain-building movements. Throughout the course of these movements Arabia in general played a purely passive and stable part. The sea, it is true, had penetrated a considerable distance into the interior at various periods, but so far as we know the deposits formed have been but little, if at all, dislocated. Philby collected Upper Jurassic fossils from various places west and south of Riyadh; and Upper Cretaceous and early Tertiary rocks have a wide, though as yet undefined, extent.

The average height of Central and Northern Arabia is probably about 3000 feet, but the rise from all directions, except from the Red Sea trough, is so gradual as to be imperceptible. On the desert-crossing from the Euphrates to 'Amman, for example, the traveller has no appreciation of the rise of the surface-level without reference to an aneroid, and the only topographical features which meet his eye throughout are some volcanic hills on approaching the Transjordanian side of the desert. Volcanic eruptions of comparatively recent age in this area and in northern Hejaz were on a considerable scale; but they did not raise any large volcanic peaks. The basalt-flows were of the more quiet "plateau" type. When discussing the relative approach of Africa and Eurasia with the consequent formation of the great Alpine mountain system, R. Staub poetically referred to the Arabian lavas as the shed life-blood of the battling continents.

In the north, in Syria, the folded ranges of the anti-Lebanon terminate abruptly against the flat and undisturbed Arabian Tableland. The mountains appear to have been thrust some distance on to their flat foreland by the intensity of the movements, with the result that the border of the folded country, as at Palmyra, is formed by a steep anticline of massive limestone, locally overfolded towards the flat plains of the Syrian desert.

The topography is everywhere very young, and in consequence these anticlines form long hill ranges, whereas throughout the Syrian desert a single horizontal limestone stratum often forms the surface over scores of miles, covered only by a thin veneer of soil or of locally derived boulders.

Along the north-eastern Arabian border the passage from undisturbed foreland to folded zone is more gradual. Along the line of the Euphrates the sedimentary covering is very thin and the folding gentle; but in

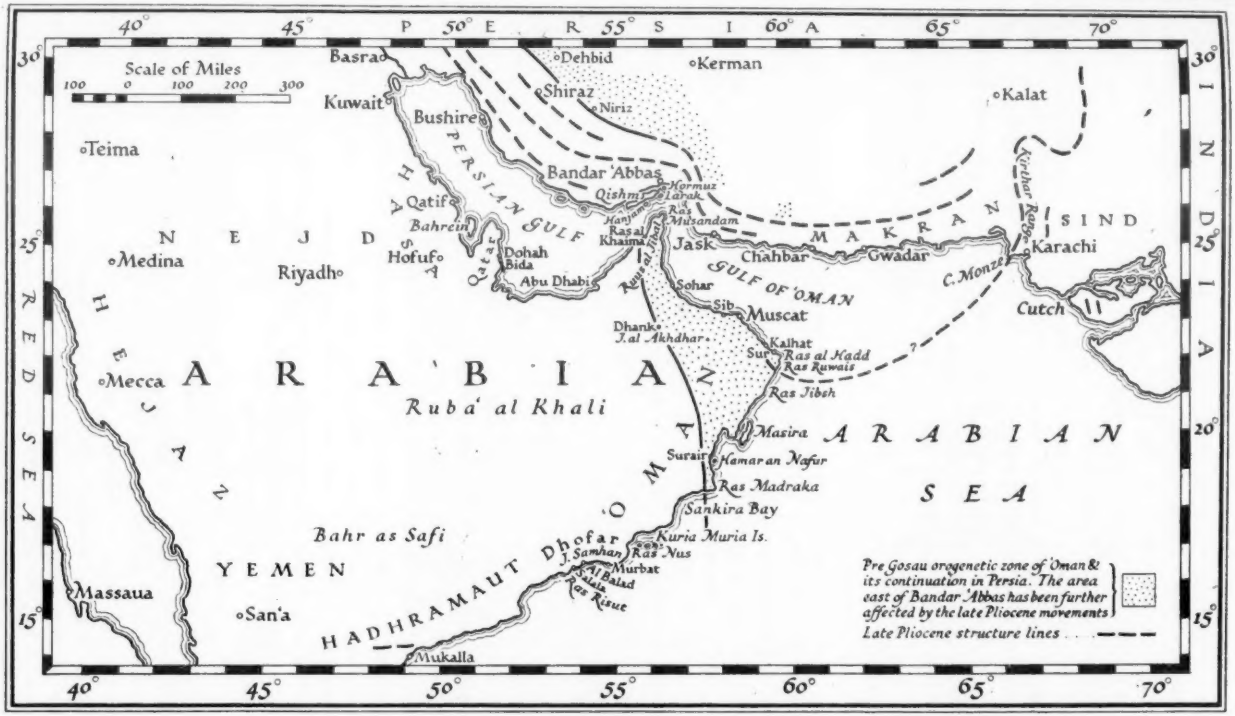

Fig. 1. Structural relations of South-East Arabia

the direction of the Persian hills the thickness of the sediments and the intensity of the folding increases until the mountain ranges proper are reached. The transition zone between has been subsequently depressed and is now occupied by the great sunken land of Mesopotamia and its continuation the Persian Gulf.

Between Kuwait and Qatif the coast-line is flat and the country is completely lacking in major features. A thin series of Tertiary arenaceous beds lies absolutely horizontal over great areas or is gently folded, and it is not until Bahrein Island is reached that we find an indication of some abnormal influence. This island is formed by an elongated dome, exposing Middle, or perhaps Lower Eocene, with its longer axis orientated N.–S. and so at an angle of about 45° to the folds of the Persian mainland opposite. Similarly Qatar consists of a gentle N.–S. fold in Middle Eocene limestone.

From here eastward, however, our preconceived ideas of the behaviour of Arabia completely break down. If Arabia were bounded by a line joining the base of Qatar peninsula and the Kuria Muria Islands it would have almost a geometric rectangular shape and a uniform geological structure. But as we are dealing with realities and not with ideals, we must find an explanation for the presence on Arabian soil of this obviously foreign element lying outside our imaginary line. The great arc-shaped mountainous belt of 'Oman projecting like a spur into the vitals of Persia and with heights reaching 9900 feet, is the most striking feature of the map of Arabia, in that it is so obviously abnormal.

To geographers and geologists alike the temptation has always proved irresistible to regard the 'Oman ranges as a detached part of Persia, as the unsubmerged part of an outer arc of the Zagros System closing again near Karachi in the Kirthar Range. The general bow shape of the 'Oman mountain belt, the marked deflection of the Kirthar Range towards the south-west to Cape Monze, and the presence of a submarine ridge joining this cape with Ras al Hadd support this interpretation of the structure: and here my difficulties commence. I must attempt to transgress our ethical code and to serve two masters. As a geographer I must admit that this supposed arc probably does actually exist in fact. As a geologist I am forced to scorn my geographical mind as being superficial.

The upheavals which produced this outer loop of the Zagros System belong to the most recent geological events, and so they have had a dominant influence on the topography. These movements were, however, only skin-deep in comparison with more ancient compressive movements which took place much earlier, namely in Cretaceous times, and which followed an independent trend. This orogenetic zone branched off from the Zagros System, and passing through 'Oman it turned southward or even to the west of south between Muscat and Ras al Hadd (Fig. 1). Its last outposts are Masira Island and Ras Madraka, after which it

Elphinstone Inlet

Dissected limestone country of Ruus al Jibal, looking S.W. from near Khasab

Mouth of Wadi Adi at Wataiya, showing 850 *feet terrace*

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Mouth of Wadi Wadaikus, showing 850 feet terrace

Abandoned village of Qusuf, Batina plain

Phot. B. S. Thomas

Wadi Fizi, Batina

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disappears into the Arabian Sea in a southerly direction, thus adding to the known number of lost mountain chains of the world. Does this ragged south coast of Arabia represent a torn edge of a continent, as Wegener would have us suppose, and if so where must we look for its counterpart? Or may we assume the continuation of the 'Oman structures under the waters of the Indian Ocean, but levelled out in the course of the subsequent ages? These problems are perhaps geological rather than geographical, but I shall return to them briefly after I have discussed the topography of 'Oman in more detail.

'Oman ranges include three strongly contrasted types of topography, governed by the nature of the geological formation. They are, 1: highly dissected limestone country; 2: dissected country composed of readily weathering igneous rocks, among which the most conspicuous member is serpentine; and 3: limestone plateau country.

The group of mountains forming the northern end of the 'Oman peninsula, collectively very aptly named the Ruus al Jibal (the heads of the mountains), are of the first type. The predominating limestone formation (the Musandam limestone) is of Jurassic and Lower Cretaceous age, and is almost 5000 feet thick where measured at Ras al Khaima. This limestone mass, in itself considerably folded and fractured, has been carved into a series of jagged spires and massive vertical walls reaching a maximum height of 6750 in Jabal Harim (Fig. 2). It is a splendid example of strongly dissected limestone country, reminiscent of the Carnic Alps, although the heights are not so great.

Northward from Jabal Harim the general height of the peaks gradually diminishes until the mountains end at Ras Musandam in abrupt though not high cliffs. The limestone is here less strongly folded, and the horizontal or gently dipping limestone sheets give a table-like character to many of the hills. The description given by Palgrave (5) of this headland is very apt. He writes (p. 316): "This strait is called the *Bab*, or 'Gate': it presents an imposing spectacle, with lofty precipices on either side, and the water flowing deep and black below; the cliffs are utterly bare, and extremely well adapted for shivering whatever vessels have the ill-luck to come upon them. Hence, and from the ceaseless dash of the dark waves, the name of *Mesandum*, or 'anvil,' a term seldom better applied."

North of the headland several isolated stacks of the same limestone rise almost vertically from 60 fathoms. They have received from our sailors the very unromantic names of Greater and Lesser Quoins, Perforated Rock, etc. The Arabs have ironically named the first *Salamah*, or "safety," and the remainder (Palgrave again) "bear the endearing name of 'Benat-Salamah,' or 'Daughters of Salamah.' In fine, what between the rocks of the cape itself, the terrible cliffs of Mesandum, the ominous Salamah and her treacherous family, worthy in every way of

Fig. 2. The Ruus al Jibal

such a mother . . . the passage is far from open and safe, especially for Arab navigators."

The coast of the Persian mainland, lying in three directions within 40 to 50 miles from Ras Musandam, offers an extreme contrast. Rocky cliffs are absent; instead the coast is everywhere low-lying, and shelves seawards so gently that vessels must anchor as much as 2 or 3 miles off shore. The actual coast is formed of recent deposits; or where older rocks come to the surface, as for instance just north of Bandar 'Abbas or on Qishm Island, they are mostly of Pliocene age. The geological strike is everywhere parallel to the trend of the coast. The Namakdan portion of Qishm and numerous smaller islands such as Hanjam, Hormuz, Larak, etc., however, form exceptions to this generalization. They might be described as geological freaks, and much speculation has arisen in the past regarding their age and origin. These islands, and also many similar occurrences on either mainland, are formed by intrusive salt bodies known geologically as salt domes.

I do not propose to describe these domes in any detail. This has recently been done by Richardson (6); but a short account of the geological processes involved is necessary in order to understand these remarkable natural phenomena.

Salt is a mineral of low specific gravity, and when under pressure it has the property of becoming plastic and is capable of flowing. It often happens that a sedimentary series containing intercalated beds of salt, or of salt and gypsum, becomes covered throughout the course of subsequent ages by a great thickness of later deposits. When the pressure on the salt formation caused either by the simple weight of the overlying rocks, or it may be by tangential pressure, becomes sufficiently great, the salt becomes plastic and flows in the direction of any point of weakness. It eventually breaks through its cover and as cylindrical plug, often several miles in diameter, reaches the surface: just as, on a small scale, when we squeeze an offending boil we force the matter to break the skin and to erupt at the surface.

Salt domes are known from many parts of the world, and although the ages of the geological formations involved and the details of the occurrences may vary, all have this in common, that they have been squeezed out from the depths by pressure. In the Persian Gulf region the age of the salt formation has remained for many years an unsolved problem. Pilgrim (7) regarded the Hormuz Series which contains the salt to be of early Mesozoic age. Three years ago I was fortunate in finding fossil evidence which indicates that the Hormuz Series is, at any rate in part, of Middle Cambrian age. These old Palæozoic rocks, which have been brought up by the salt as a jumble of great blocks, appear at the surface surrounded in many cases by young Tertiary formations. The latter are invariably steeply inclined around the periphery of the intrusive body.

Perhaps more impressive than the heights of the Ruus al Jibal complex

are the negative features, the wonderful system of drowned valleys which penetrate fiord-like as much as 9½ miles into the mountains (Fig. 2). They are quite peculiar to 'Oman and have no counterpart elsewhere in the Persian Gulf or around the Arabian coast.

The most spectacular of these fiords is the Khor ash Sha'am, or Elphinstone Inlet. It has a narrow entrance only some 500 yards in width, on either side of which the almost vertical walls rise to heights of 3000 feet. Once past this narrow entrance the inlet widens out considerably, owing to the appearance of soft Triassic shales and sandstones from under the massive Musandam limestone. There is a depth of water throughout of 20 to 25 fathoms, and in consequence this inlet could accommodate a whole fleet. It offers a most picturesque and romantic sight, this wonderful apparently land-locked bay of the deepest sparkling blue surrounded by towering jagged heights rising often precipitously from the water's edge. But its beauty is offset by other disabilities. The picturesque circle of crags successfully shuts out the sea breezes which alone make life tolerable in the summer in the Gulf, with the result that Elphinstone Inlet has achieved the reputation of being one of the hottest and most oppressive places in the world. The Eastern Telegraph Company once established a station on an island in this inlet, but in consequence of a revolt of the staff they were forced to abandon it in favour of the more prosaic but more healthy island of Henjam.

Branching off these inlets are numerous other side valleys which belong to the same system, but they have become blocked with shingle. The village of Khasab lies at the mouth of a long dry creek about 400 yards wide, bounded by vertical limestone cliffs. The villagers eke out a miserable existence from date-palm culture on the flat shingle valley bed. The gardens are irrigated by wells dug down in the shingle to the water-table. The depth of the wells decreases with the proximity to the creek mouth, but the salinity of the water increases correspondingly. The least brackish water is obtained from a well about a mile above the village, where the water-table is reached at a depth of 180 feet without touching the solid rock floor of the valley. Cattle brought from the Makran coast are used for raising the water, and as their sole diet consists of ground date-kernels and fish the hard work soon reduces their condition, probably never of the best. Two or three years is the limit of an animal's useful existence; and when of no further service the poor emaciated beast is staked out on the outskirts of the village to die of starvation. Being devout Mohammedans they may not eat an animal which has been used for work, nor may they wantonly kill it, nor have they surplus fodder for any animals not actually in service.

There can be no doubt that these inlets represent drowned valleys, and they afford an excellent example of a Rias type of coast. These valleys were carved out by natural agencies in some former geological epoch when the relative height of the land was very much, perhaps to

the extent of some thousands of feet, higher than at present. As a result of a subsequent positive movement of the shore-line these old valleys have been invaded by the sea, and the present system of inlets is the result. The present sea bottom does not represent the rock floor of the old valley, for with the gradual rise of the sea-level the valleys would tend to choke themselves with shingle. Unfortunately, accurate data are lacking on which one might base sections across the valleys in order to estimate the possible depth of the solid rock bottom. Such sections as I have been able to make, with the assistance of sketches made at the time, and of the Admiralty Chart, show that the solid rock in the centre of the valleys must be at least between 1000 and 1500 feet below the present sea-level, and perhaps considerably more.

I have also made use of another method to arrive at the same result. The rivers which excavated these steep-sided gorges had considerable erosive power, and one may assume a gradient of at least 100 feet per mile. Elphinstone Inlet has a length to the narrow entrance of 9 miles, so, assuming such a gradient, the rock bottom would be at least 900 feet below sea-level at this point. We have, however, no means of estimating how far to the west the shore-line lay at the time of the excavation of the valleys. I think 1500 feet is a very conservative figure to assume for the amount of the depression of the land, and if one were not handicapped by the necessity for assuming minimum figures when making calculations with insufficient data, I should have hazarded a guess of twice that figure.

It is impossible to date the period of the erosion of these valleys. The upper part of the massive Musandam limestone is of Lower Cretaceous age, and the whole of 'Oman was subjected to intense compressive movements between this time and the Cenomanian epoch. Considerable erosion of the newly formed ranges had taken place before the greater part, if not the whole, of the country was submerged by the Upper Cretaceous transgressive sea. It is impossible to disprove that the excavation of these valleys did not commence during this period of erosion, but for a variety of reasons I do not consider it probable. Throughout the Upper Cretaceous and early Tertiary, 'Oman remained for the greater part submerged, and the next phase of movement of which we have evidence is post-Miocene. The intensive folding of the Persian coastal belt is of late Pliocene age, but 'Oman played essentially a passive part. In the central and eastern part of 'Oman the Tertiary rocks have been gently folded in a north-westerly and south-easterly direction; but in the Ruus al Jibal where the older structures strike north–south, that is at right angles to the advance of the Persian Pliocene folds, it is unlikely that any simple folding can have resulted. Perhaps instead an elevation took place. I think that the excavation of the valley system is probably of Pliocene age, in which case the subsequent depression is still more recent.*

* When discussing the relative depression of the land, Pilgrim wrote (7, p. 60): "To movements of this nature do we owe the deeply cut inlets of Mazandam and

In other parts of 'Oman, as I shall describe later, the most recent movement is an elevation of about 1300 feet, as shown by raised beaches at that height. In the Ruus al Jibal area, however, I did not observe any definite marine terraces. There are many platforms at various heights, but these might be merely the effect of erosion where the limestone lies horizontal. More detailed investigation would be necessary in order to establish this important point, whether terraces are really present here. If so, are they younger or older than the valley system? If not, how is the depression of this area related to the elevation of the country farther south? I shall show that this elevation was not a simple vertical movement, but rather a gentle, asymmetrical warping, so perhaps the Ruus al Jibal lay in a syncline and was depressed simultaneously with the uplift farther south.

The country lying south and south-west of Muscat, behind the belt of serpentine in which the town itself is situated, is of similar nature to Ruus al Jibal, though not so grand. In the centre of this limestone complex lies the plain of Saih Hatat. The rocks forming the plain are soft phyllites in contrast to the hard limestones and quartzites by which it is surrounded on all sides, and the excavation of the plain has been brought about by appearance of these softer rocks. The Saih Hatat is about 20 miles long and 15 miles broad at the north-western end, but in the other direction it narrows rapidly. It is crossed by a series of river courses which enter the limestone belt on the north-eastern flank in a series of narrow gorges, such as Wadi Adi, Wadi Maih and Wadi Helu. The last two wadies join at Yitti, where they form a tidal creek. It is also a drowned valley, but on a very much smaller scale than those in the Ruus al Jibal.

A very outstanding feature of this region is the well-marked terrace which planes off the steeply dipping limestones at a height varying from 800 to 1000 feet. At the mouth of Wadi Adi and of Wadi Wadaikus it is very prominent; and looking south-eastward from a prominent conical hill (1220 feet) 4 miles due south of Muscat it may be seen for a long distance towards the base of Jabal Abu Dand. This platform appears to be older than the river gorges.

The Sumail Igneous Series has probably the greatest areal extent of all geological formations in 'Oman. A continuous belt stretches from the south end of the Ruus al Jibal limestone country, inland from Khor Fakkan, to the north end of the Jabal al Akhdhar group. Pilgrim found it in Wadi Sumail, and Miles has mentioned the black rocks of Muscat in Wadi Tayin. At Ras al Hadd, Ras Ruwais, and Ras Jibsh serpentine and diorite appear from under a cover of recent miliolite (a limestone

the islands dotting the Gulf, which are merely isolated peaks of the Hormuz volcanic series just rising above the surface of the water." I have already explained how these islands owe their existence to the uprise of the salt masses. This phenomenon is in no way related to the depression of 'Oman.

formed of tests of the small foraminifer *miliola*). Masira Island and Ras Madraka are formed of the same rocks. We have explored nearly 4000 square miles of igneous country, and the real extent is probably very much more.

The series consists partly of intrusive rocks, diorite, gabbro, and serpentine, and partly of lava-flows ranging in composition from Keratophyres to basalts. These rocks disintegrate rapidly in a climate of alternating torrential rainstorms and dry hot periods. No vegetation is possible to protect the loose rubble on the hillsides, so weathering proceeds rapidly; and in place of the great massive features and the vertical faces of the limestone country, the igneous series weathers to form a maze of jagged pyramidal peaks. The average height of the peaks is about 4000 feet, and the greatest vertical difference observed between valley floor and neighbouring peaks was 3500 feet. Mapping in this igneous country is very difficult. Many of the peaks are unscaleable owing to the steepness of the slope and the loose rubble, and if by good fortune one does reach a view-point the surroundings consist of a maze of jagged peaks among which it is very difficult to select one which will be recognizable from a different angle. Compasses are frequently useless owing to local magnetic disturbances. These effects are often so local that we have found a difference of 45° between sights taken standing and lying. Occasional inliers of a lower shale and limestone group appear in the igneous belt, the largest of such inliers being Jabal Rais and Jabal Sumaini.

The main valleys in this serpentine-diorite zone, such as Wadi Sumail and Wadi Jizi between Baraimi and Sohar, have already been described by several travellers. They are mostly narrow valleys out of which the bare rugged crags rise steeply. Here and there the sides recede somewhat and allow space for terraced gardens and a little cultivation. In some cases there is perennial flowing water, and in others water for irrigation is obtained by tapping the undertow in the shingle floor.

During the course of five traverses which I made through the mountain belt between Wadi Hawasina and Wadi Hatta I made frequent observations of relative heights of terraces, but at first with very puzzling results. Wadi Hatta, however, afforded evidence which allows a satisfactory explanation. At the point where this wadi emerges into the coastal Batina plain there are two well-defined terraces at relative heights of 90 and 30 feet. They do not end in a cliff towards the plain, but gradually converge and merge into it. At 'Ajib the wadi is fully graded and depositing; but 32 miles higher up it is cutting strongly into its rock base in a narrow gorge. At Mushebba, 5 miles above 'Ajib, the sides of the gorge recede and the wadi is once more graded and flows in a broad valley. From here to the watershed these conditions remain fairly constant and terraces are lacking. The watershed itself is in a broad open plain, a striking contrast to the watersheds in the Jabal Rais country, where steep ridges separate the east from the west-flowing

streams. In Wadi Ahin at Hubaitha, which is about the same distance into the mountains as Mushebba, I noted a terrace with fluviatile shingle at 375 feet above the wadi floor. In an attempt to reconcile these

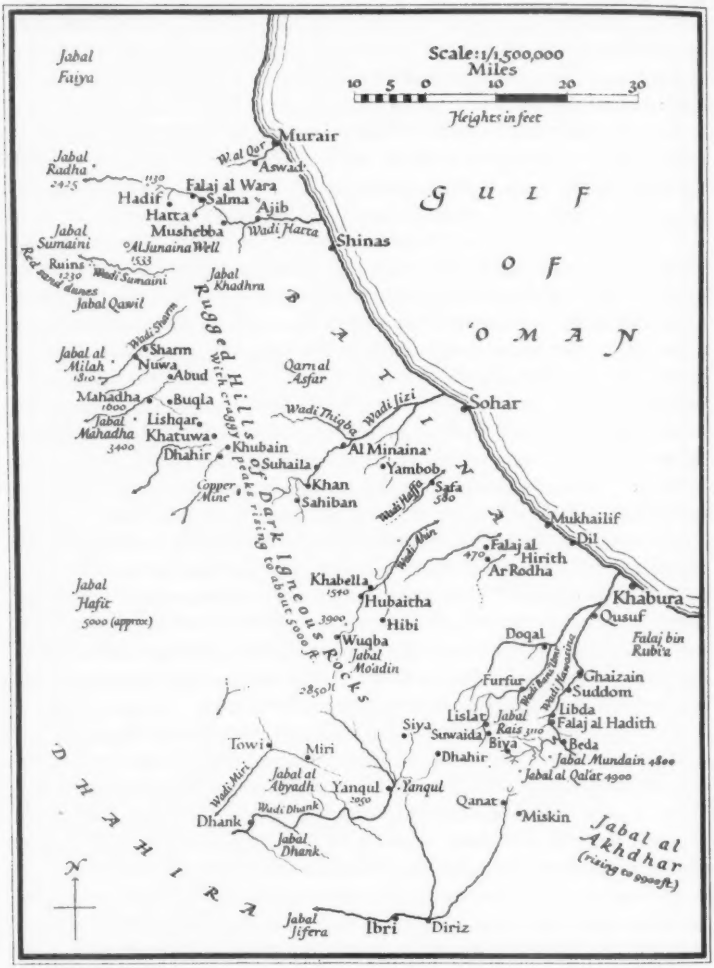

Fig. 3. The Batina coastal plain and mountain belt north of Jabal al Akhdhar

apparently conflicting observations I was fortunate in finding at Falaj al Wara and Salma in Wadi Hatta many fragments of sub-recent marine shells strewn on the surface. This point has a height of 1045 feet, and is

about 5 miles from the watershed, which is at 1130 feet. The shells, which are unfortunately too fragmentary to identify specifically, include Venus, Turritella, Cerithium, Cardium, Dentalium, etc. The state of preservation is similar to that of the shells of the low sub-recent raised beaches along the coast, and very different from that of Pliocene fossils elsewhere in the Gulf region.

From the watershed westward, the surface of the desert falls imperceptibly and regularly towards the Persian Gulf, and the wadi courses as they emerge from the hills lose themselves in the plain. Near the ruins of an old village, where the Wadi Sumaini emerges into the plain just south of the Jabal of that name, I found some oyster fragments on the surface at a height of 1230 feet.

I have plotted these results on a section (Fig. 4) which shows that in very recent time this part of 'Oman has been subjected to a gentle arching, and sub-recent marine deposits have thus been elevated to a height of 1230 feet. The structure is somewhat asymmetrical, with the result that the wadis on the eastern side have been rejuvenated, while from the watershed westward the gradient is too small to give the wadis excavating power.

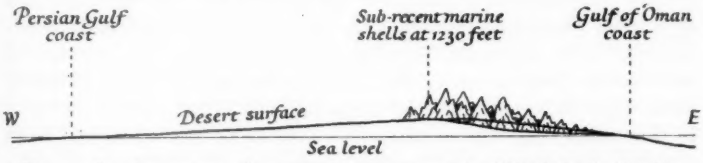

Fig. 4. Section across the mountain zone north of Jabal al Akhdhar

This contrast is everywhere apparent. In the Jabal Ruus vicinity the wadis flowing into the Dhahira plain are gentle and graded, while those flowing eastward occupy narrow gorges. At the south-eastern end of Jabal Ruus itself a wadi has excavated a splendid example of epigenetic valley in the massive limestone. The limestone mass pitches-out not 2 miles farther south-east, and the wadi could easily have avoided this obstacle. Instead it maintained its former course and cut a deep narrow gorge in the limestone.

As I have already stated, I am at a loss to know how to correlate these facts with the phenomena at Ruus al Jibal, where instead of elevated beaches there is evidence of depression of about the same amount. Unfortunately I was unable to visit the intervening country, and so this interesting problem must await further exploration. These recent movements are confined to the mountain zone of 'Oman. Elsewhere around the Arabian coast there is a well-marked terrace which for long stretches maintains a constant height of between 100 and 150 feet. It is a result of epirogenetic movement and not of arching, or "Undation" according to the terminology of Stille, as in the case of 'Oman

The third type of country which I was able to distinguish is the lime-

stone plateau country. The greater part, if not the whole, of 'Oman was submerged by the sea during Upper Cretaceous or early Tertiary time, when the older folded rocks were covered by massive limestones or marls. These now lie in great horizontal or gently folded sheets and give rise to a very characteristic type of topography.

At Yanqul the Upper Cretaceous and (?) Eocene limestones have a thickness of 2500 feet, and they form the great scarp of Jabal al Abyadh (4970 feet). Looking westward from the summit, this bare massive limestone falls in a series of gentle undulations until it reaches the plain 20 miles to the west. Yanqul Wadi cuts a deep gorge in this limestone, finally emerging into the plain at Dhank.

Owing to political difficulties I was unable to visit Jabal al Akhdhar, but from its appearance in the distance and from the description which Sir Percy Cox has been kind enough to give me in a private communication, I suspect that the Jabal al Abyadh conditions are here reproduced on a much grander scale. The great scarp of Jabal al Akhdhar (9900 feet) is the most prominent landmark of 'Oman. It is a great towering mass of limestone with an almost vertical long limestone face directed seaward and overlooking a tangle of low broken hills. The crest is formed by a great plateau which falls, as far as I could see from the distance, about 10° south-westward. The basal two-thirds of the cliff is composed of a massive limestone unit; then there is a set-back probably indicating some softer beds, and the upper 2000 feet or so form a separate scarp. Is this upper limestone of Upper Cretaceous or Eocene age? Miles describes the summit in considerable detail. He writes (2, p. 482), "the plateau declines gradually from north to south, and then falls rapidly to the plain in cliffs which, though wild and striking, are less imposing in their grandeur than those on the seaward front." Blanckenhorn (8, p. 66) states that the scarp of Jabal al Akhdhar is composed of white nummulitic and alveolina limestone, but I have been unable to trace the source of his information.

The desert plain to the west of the mountain ranges is broken by several hog-back limestone anticlines. In the north Jabal Faiya has a relative height of only about 300 feet. Jabal Hafit, on the other hand, rises to nearly 5000 feet, or about 4000 feet above the plain. Jabal Kur, lying south of Jabal al Akhdhar, seems to be somewhat similar according to Miles' description. The two first-named hills were only seen in the distance, but from their general appearance I expect that they are formed of the same limestone formation as Jabal al Abyadh. Further, I expect this limestone has a considerable extension all along the south-western flank of the mountain ranges. Jayakar collected a Lower Eocene fossil somewhere in the Sharqiyah province.

Towards the south-east the altitude of the 'Oman ranges gradually decreases. At Kalhat an anticline in the Upper Cretaceous–Eocene limestone forms a 3000-feet ridge which is cut by the gorge of Wadi

Qodha. In the hinterland of Sur the hills are low, and major topographical features are lacking. The Tertiary rocks (here including Miocene) are gently folded with dips ranging up to 15° and a strike direction of north-west to south-east.

The coast-line from Ras al Hadd to Dhofar has been described in considerable detail by Carter (9). It is mostly low, monotonous, and arid to an extreme degree, and composed of horizontal or gently warped sheets of Upper Cretaceous or Eocene limestones, or of more recent deposits. In a few isolated localities, such as at Ras Ruwais, Ras Jibsh, Masira Island and Ras Madraka, the older rocks of the Sumail Igneous Series appear from under this unconformable cover and form low hills.

This part of the coast-line lies between two areas of rainfall. 'Oman proper, owing to the height of its mountain ranges, receives sufficient, if not excessive, winter rains. Dhofar has a regular supply of summer monsoon rain, while the stretch of coast in between receives either the tail end of one or other or, as often happens, none whatsoever over two or three years. Notwithstanding the apparent inhospitality of the country it supports a certain population of Badawin tribesmen. Surair (opposite Hamar an Nafur Island), where we made a landing, is a village of about twelve poorly built huts. The people live mainly by fishing, but they have also camels and even some goats. Their water supply is from a well in the shingle bed of a wadi about a mile behind the village. The water is only slightly brackish, and the supply is maintained, although the rains may fail for two consecutive years. This fact indicates the presence of higher ground inland which could catch a more plentiful and regular supply of rain-water. Carter, indeed, records heights of 4000 feet inland from here; but from a commanding view-point I was unable to see anything higher than perhaps 200 feet. If higher ground does exist it must be at least 30 or 40 miles farther inland.

The natives of this delectable coast-line are so jealous of their independence, and so fearful of the possibility of our peaceful penetration, that no amount of persuasion or argument could elicit any information whatsoever from them regarding the natural features of the country, or even place-names. Mr. Thomas had made previous arrangements for our landing here, and we were met on arrival by Shaikh Mansur and about 150 wild and gaunt Jannabah tribesmen. Our welcome could not be described as cordial, nor were any regrets expressed on our departure.

On the mainland opposite the Kuria Muria Islands gentle folding again becomes evident, and the cliffs rise to 4000 feet. Between Ras Nus and Murbat the ancient crystalline rocks are exposed and form a low coastal plain. They are overlain by a massive sandstone formation which in turn is covered by Upper Cretaceous and Eocene limestones and marls. The latter reach a height of 3700 feet in Jabal Samhan, a long crescent-shaped scarp the two ends of which approach the sea at Murbat and Ras

Risut. In between these points the hills recede some 10 miles from the coast, forming the fertile, well-watered plain of Dhofar.

The Samhan hills receive a plentiful supply of summer monsoon rains, and in consequence they are clothed in a wealth of tropical vegetation—a striking contrast to the naked crags of 'Oman. It is the frankincense country, with which the names of Theodore and Mrs. Bent will ever be associated (10). It is a land abounding in interest, botanical, zoological, ethnographical and archæological. The flora is tropical, coconut palms replace the date palms of 'Oman, and the hills are covered by a dense growth of trees, most of which were unknown to me. Unfortunately, owing to the conditions of this part of the expedition, the collector, Mr. Fernandez, was forced to remain behind at Muscat, and our geological work and mapping, interspersed with occasional bouts of fever, fully occupied the short time at our disposal. Mr. Kinnear, of the British Museum, is particularly anxious to have a collection of birds from this country, completely unknown in this respect. It is to be hoped that the next traveller in Dhofar will bear this in mind. As far as is known, the larger animals of Dhofar are not very different from those in the rest of 'Oman, but a complete contrast is afforded by the fresh-water gasteropods. A small collection which I made has been examined by M. P. Pallary, and will shortly be described in the *Proceedings* of the Malacological Society. They have several forms in common with the collection made by O. H. Little at Makalla, but apparently not a single Dhofar species occurs in 'Oman proper, and *vice versâ*. The intervening stretch of desert coast seems to form an absolute barrier to their migration.

I examined in passing the old Sabæan ruins at Al Balad and Robat, but I have little to add to the descriptions given by Carter and by the Bents. The only new archæological discovery which I was able to make was a find of some flint implements (described in Appendix). They are very poor, but are of interest in that they are the first to be found, to my knowledge, in the whole of South Arabia. The country is for the most part completely devoid of flint, and it was actually beside the only flint outcrop which I saw during my entire trip here that I found the implements. Perhaps with better opportunities some interesting material might be collected

Regarding the interesting non-Arab tribes, the Mahri and the Gara, I understand that Mr. Thomas has made more complete philological and ethnographical observations, which he will eventually publish. In general type, cast of feature and the frizzly hair, these natives reminded me strongly of the Hadandowa tribesmen of the Sudan Red Sea littoral. They are entirely nomad, and live under the shelter of trees or in caves. They have no cultivation, but live on the produce of large herds of cattle and some camels. I found them always very friendly, and on several occasions I was persuaded to partake of a meal with them under the shelter of a great spreading sycamore tree. The meal was served very

simply in two large wooden bowls : one contained round balls, about the size of marbles, of minced meat cemented with fat, and the other, milk. Their diet consists exclusively of meat and milk products. Firearms are very scarce among these tribes ; instead they are armed with very poor-quality swords and small shields of wood or shark-skin. They are also very adept at throwing a short pointed stick.

The plain of Dhofar is well watered by a number of copious springs, some of which emerge close to the shore-line and some at the base of the Jabal Samhan scarp. The water has a high lime content, and at many places in the hills great festoons of calc sinter have been formed by the springs. They are decorated by a luxuriant growth of ferns and are surrounded by great stately trees, rendered still more picturesque by a wealth of various creeping plants, among which convolvulus, rich in blossom, is always prominent.

The country lying to the north of Dhofar as far as I could see, and according to the descriptions of my local guides, consists of a rolling limestone plateau, becoming increasingly bare and waterless with the distance from the coast. The Gara tribal country extends for a considerable distance—I was told ten days' march—inland, after which the desert begins. In the Hadhramaut the limit of the real desert lies about 150 miles inland, and probably similar conditions obtain here. The edge of the sands probably marks the northern limit of the transgressive Upper Cretaceous limestone series, and the emergence either of the ancient crystalline rocks or of the Mesozoic sandstone formation. The outcropping geological formation is usually the controlling factor in the formation of great deserts, and is more important than the immediate climatic conditions. A limestone or, better, a limestone formation with interbedded marls not only forms a hard steppe-like surface but water may travel for enormous distances in porous beds under suitable conditions, producing oases in country otherwise completely barren and waterless, as for example at Hasa. If however the surface is formed by a massive sandstone formation, the ground water, if present, lies at the base of the sandstone and usually quite out of reach by ordinary means. The manner in which a sandstone disintegrates to form blown sand deposits is readily understandable. It would be interesting to examine a sample of sand from the great Ruba' al Khali. Where a desert sand has been transported a great distance by wind the grains become perfectly rounded and acquire a high polish. The sand which I examined from the fringe of the desert in 'Oman was not of this type, as I shall describe later, indicating a local origin for the sand. I made inquiries about the possibility of crossing the Ruba' al Khali, but I was unable to extract any satisfactory information.

I have so far omitted any reference to the plains of 'Oman. The great crescent-shaped Batina coastal plain, some 150 miles in length, has frequently been described by various authors. The plain has an average

width of about 10 miles, and is mostly well wooded with acacia trees. The cultivable area is limited to a narrow strip along the shore where the wells tap the water-table as it approaches the sea. From Sib to Murair the date gardens are almost continuous, and the number of villages must run into hundreds. Miles has estimated the population of the Batina plain at three-quarters of a million. There are very few villages in the zone between the actual coastal belt and the edge of the mountains; and where they do occur, as for example Qusuf, the presence of water is due to a gentle arching of the strata. Incidentally Qusuf affords evidence of a steady desiccation of the country, of which we heard complaints everywhere. It had always been a prosperous village, but for the past seven years the wells have failed, of which fact the dead stumps of the date palms bear mute evidence. Also in Wadi Hatta there are several villages quite recently deserted owing to the failure of the water supply. Another instance is at Jabal Sumaini, where I found ruins of a village. I was told that it was abandoned forty or fifty years ago owing to the failure of the water.

The plains on the western side of the mountain range have also been amply described by Col. Miles and Sir Percy Cox. The average level of the plain at the edge of the hills is about 1300 feet, and as I have already explained, this height represents a comparative recent elevation. I encountered the sand desert only at one place, namely near Jabal Sumaini, where it encroaches into contact with the hills. It is remarkable in that the sand has a reddish-orange colour, and the great expanse of rolling dunes of this colour affords a unique spectacle. The nature of the sand was noticed by Pilgrim (7, p. 100), who wrote: "Their red colour is due to red chert grains, but where the rock is situated, that has by its erosion produced all this material, I am unaware." The sample which I collected * proved on examination to be a quartz sand in which the grains had a ferruginous coating, readily removable in hydrochloric acid. Regarding the origin of the sand, I suspect the Palæozoic sandstones of the Hormuz Series. They are the only ferruginous sandstones known in the Persian Gulf area. The Admiralty chart marks an area of volcanic rocks on the Trucial coast west of Abu Dhabi, which I expect will prove to be Hormuz inliers. If the sandstones were here well developed, as is the case on the opposite side of the Gulf at Al Buza and Hamairan, they might be the source of these desert deposits, or they might outcrop normally at the surface farther inland. The sub-angular shape of the grains shows that the sand has not been transported very far by wind.

Geology.—I have submitted the geological results of our expedition in a paper to the Geological Society, but a short summary is necessary in order that one may understand the physical geography of South-Eastern Arabia.

The great compressive forces which, acting on certain unstable zones

* Now in the Museum of the Society.

of the Earth's crust—the geosynclinal areas—eventually produced the Alpine–Himalayan–Andine Mountain systems, were not strictly contemporaneous throughout the world. Even in any one given system the movements took place usually in two or more phases, separated by considerable intervals of time, throughout Mesozoic and Tertiary. For example, in the Alps the first important phase of movement took place in Cretaceous time between the Neocomian and Cenomanian. This phase has been named the pre-Gosau (vorgosauisch) movement by the Austrian geologists, a name which implies the presence of transgressive Upper Cretaceous deposits, the Gosau formation, lying with strong unconformity on the earlier Mesozoic or older rocks. The pre-Gosau movements in the Eastern Alps were on such a scale that nappes, or great thrust sheets, were formed, and some geologists are of the opinion that this phase rivalled in intensity the later Tertiary movements.

Throughout the Alpine system one may formulate a general rule that the earliest phase or phases of movement took place in the inner zones, and with the lapse of time the zone of sedimentation, which in turn was subjected to compression, became displaced outwards towards the stable foreland. Thus in the Austrian Tirol the pre-Gosau movement affected the inner zone only; while throughout the period of movement uniform sedimentation progressed in the outer Flysch zone. The first strong movements in the latter zone took place in Oligocene or early Miocene time. In the Swiss Alps the same scheme is undoubtedly applicable; but, owing to the absence of the transgressive Gosau formation, concrete evidence of the earlier movement is lacking.

If we apply this rule to South and South-Western Persia we find that although the details of structure may be different the general scheme is valid. A broad zone of country with Mesozoic and Palæozoic rocks lying between Kerman and Niriz and striking north-west to south-east had been intensely folded before the Upper Cretaceous marine transgression took place. In the more south-westerly zone the oldest rocks known are Aptian (perhaps also Jurassic *), and conformable sedimentation continued throughout the Cretaceous and Tertiary, disregarding for our present purposes some minor transgressions indicating gentle warping movements. The first major folding movement in this zone took place in the Pliocene, when the long regular system of anticlinal ranges stretching from Mosul into Baluchistan, was formed. To the south-west of this folded belt lies the depressed Mesopotamian–Persian Gulf zone, and then the great stable Arabian tableland.

'Oman, however, refuses to conform to this general scheme. It is a belt of country which has been intensely folded, to the extent of the production of true Alpine nappe structures, in pre-Gosau time; and yet it lies outside the late Tertiary folded zone of the Persian coastal belt.

* Private communication by Dr. J. A. Douglas kindly shown to me by Mr. F. D. S. Richarson.

At first I regarded 'Oman as an independent foreland folded zone, but eventually I was forced to abandon the idea. The stratigraphical sequence contains many very characteristic rocks, such as a series probably of Jurassic to Lower Cretaceous age, and quartzites with a strong development of red and green radiolarian cherts, the so-called radiolarites, associated with great masses of serpentine and other igneous rocks. These rocks reappear on the Persian mainland north-east of Bandar 'Abbas, and from there form a continuous zone through Niriz and Deh Bid. My colleague, Mr. K. Washington Gray, who has since had a very wide experience in South Persia, has kindly described for me the geological structure at Niriz. The strongly folded shales, radiolarites, and basic rocks are unconformably overlain by a massive Upper Cretaceous limestone, producing a landscape, geologic as well as scenic, identical with that at Jabal al Abyadh, near Yangul in 'Oman. The continuity of the 'Oman pre-Gosau folded zone into Persia appears to be indisputable. The once connected structures were broken across by the Upper Cretaceous–Tertiary sedimentation zone of the Persian coastal belt, and in late Pliocene time the folding followed a trend quite independent of the older tectonics. The influence of the latter is shown only by the marked kink in the strike between Bandar 'Abbas and Jask (Fig. 1).

I have already said in my introductory remarks that the supposed outer loop of the Zagros System passing through 'Oman and eventually joining the Sind ranges seems to exist in fact; but that from a geological point of view this is unimportant. Throughout 'Oman the Upper Cretaceous and Tertiary rocks have been very gently folded, except for one or two instances of local crumpling. The great elevation of the ranges does not necessarily indicate a compressive movement; and, as we have seen, part of this elevation may be assigned to very recent warping movements. Probably of still later age is the breaking down of the eastern flank of the mountains and the formation of the Gulf of 'Oman.

The Cretaceous movements, on the other hand, were of a very different order of magnitude. The essential process was here deep-seated and has produced at the surface a complex of great overthrust sheets or nappes, rather than simple folding. The outpouring of great quantities of volcanic rocks and the presence of enormous masses of intrusive rocks also afford evidence of the magnitude of the forces involved.

The Cretaceous, or pre-Gosau, folded zone of 'Oman may be followed for a distance of over 600 miles from Ras Musandam through 'Oman proper to Masira Island and Ras Madraka, where it disappears into the Arabian Sea, striking in a southerly direction. The problem of its further continuation involves many theoretical considerations which are outside the scope of this work, and I refer those interested to my paper to the Geological Society, in which I discuss the various alternatives.

I do not consider that the complete absence of a submarine ridge is valid evidence against a further extension of this folded zone under the

waters of the Indian Ocean. The pre-Gosau mountains had been almost completely levelled down by erosion before the Upper Cretaceous and Middle Eocene marine transgressions took place. Probably the whole country was submerged in Middle Eocene time, and if one could put the time clock back and send a hydrographer to survey this sea, he would doubtless stoutly deny the existence of a submerged mountain system. The elevation of the 'Oman ranges is of later date; Masira Island and the supposed continuation of the older folded zone in the Arabian Sea lay outside this arc of more recent movement; and consequently it does not indicate its presence in the surface relief. The field is thus open for speculations. Kober (11), who is the only dissenter from the generally accepted 'Oman–Sind arc theory, has made the 'Oman orogenetic zone eventually circumscribe the African continent. The relation of the Dobruja to the Carpathian arc is somewhat analogous. The Dobruja is a fragment of a once continuous pre-Gosau system, but it was unaffected by the Tertiary movements which followed a completely independent trend: that of the present Carpathian arc.

In conclusion, I should like to examine briefly the Wegener theory (12) in as far as it affects South-Eastern Arabia. According to the theory of continental drift, the Indian peninsula started on its journey in early Mesozoic time from its birth-place adjacent to Madagascar, which in its turn nestled against South Africa. This theory has been elaborated and applied in a most masterful manner to the tectonics of Asia by Argand (13). The figure (Fig. 5) which I reproduce redrawn from the latter work clearly shows how the drifting of India away from and past Arabia must have produced in the Arabian Sea an area of tension on a grand scale.

The assumed drift was, of course, a very slow and not necessarily a uniform process, but owing to the essential difference between the sial blocks and the sima, it appears to me unlikely that geosynclinal conditions of deposition (*i.e.* shallow water) could have existed in this ever-increasing gap, at any rate in its later stages. I might state (as may indeed be already apparent) that I am not a pro-Wegenerist, for a variety of reasons based on fundamentally different hypotheses; but I appreciate the ingenuity and elasticity of the theory and the difficulty of attacking it conclusively. Thus in regard to the area in question, if we assume that geosynclinal sedimentation did take place in the growing gap between Arabia and India, we must suppose that the drift of the latter was checked in Lower Cretaceous time and a relative approach of the two units took place, producing an orogenetic zone with a north-south trend.

Argand does, in fact, guard himself, with a superb command of language and of argument, against subsequent discoveries which might seem prejudicial to his case. He writes (13, p. 321): " La dépression dite géosynclinal de Mozambique, allongée du canal de ce nom à la mer d'Oman, est d'origine essentiellement distensive quant à ses premiers jeux discernables, que datent du Lias entre Madagascar et l'Afrique,

et quant à ses derniers jeux importants. Nous avons relevé quelques jeux andins de nature probablement plicative, au bord de l'Afrique orientale. Bien des alternances de compression et de distension ont pu affecter cette aire au long du cycle alpin, mais il semble qu'aucun plissement neuf de très grand tonnage n'ait pris naissance dans ce géosynclinal ; la tranquillité assez générale des couvertures, en Afrique et à Madagascar comme

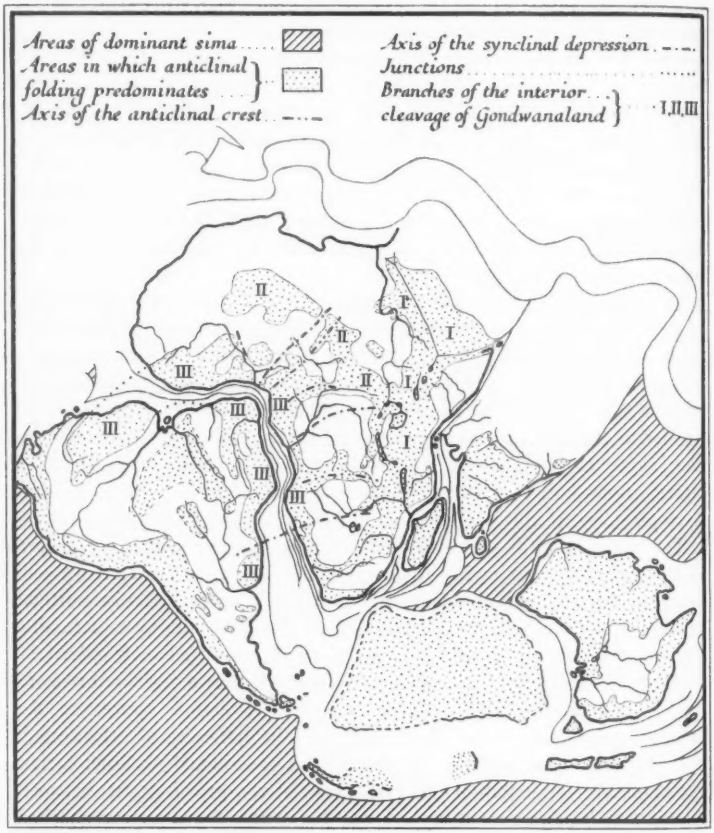
Areas of dominant sima
Areas in which anticlinal folding predominates
Axis of the anticlinal crest
Axis of the synclinal depression
Junctions
Branches of the interior cleavage of Gondwanaland
I, II, III

Fig. 5. The folding of the Gondwana continent. Redrawn from a figure in Emile Argand's 'La tectonique de l'Asia'

du bord occidental de l'Inde péninsulaire, tranquillité qui n'est guère troublée que par des cassures distensive et par des flexions, le fait voir."

If the 'Oman structures were merely gentle flexures, such as do occur along the East African coastal belt, one could not find fault with Argand's reasoning, but the tectonics of 'Oman indicate that the country is an

isolated portion of a once continuous zone of compression of the first order of magnitude. I regard this fact as entirely antagonistic to the conception of the drifting apart of India and Arabia, with however many temporary checks and reversals of the movement. The drift of India, as postulated by Argand, had two components—a northerly movement which crumpled the Himalayan system against the great buttress of Northern Asia, and an easterly swinging movement which carried the southern extremity of the peninsula relatively through about 40 degrees of longitude. Even were it possible to reconcile the latter component with the known facts, the effect of the former must not be overlooked. This notion of a great lateral slipping movement of one block past another is quite feasible if the two units are floating freely in a semi-fluid medium, namely the sima. But where sedimentary rocks are concerned such conditions could never produce Alpine type of geological structure. A criticism of Wegener hypothesis really revolves around the question of how far such a theory may be stretched before it breaks.

APPENDIX I. THE WATER SUPPLY OF BAHREIN

Bahrein Island owes its existence to a gentle dome in Middle and possibly Lower Eocene rocks, mostly limestones and marls. The island has often been described and has been studied in detail by Dr. Pilgrim (7) of the Indian Geological Survey, but the question of the source of the water which emerges in numerous copious springs at the northern end of the island and even in the sea, has never been discussed.

The centre of the island is occupied by a large depression surrounded by an elliptical scarp of Eocene limestone. The catchment area of this depression may be simply estimated and the annual rainfall is known. A simple calculation, however, shows that the amount of rainfall in this area would only provide a small fraction of the volume of water which flows from the numerous springs on the island, and this flow is quite constant, although the local rains may almost fail in some years. The water must therefore have its origin on either the Persian or the Arabian mainland. For geological reasons the former is most unlikely, and an assumption of an Arabian source has the support of the copious springs at Qatif and Hasa oasis, where the rainfall is considerably less than at Bahrein. The ultimate origin of this water must be sought in the highlands of Nejd, which is the nearest locality with a sufficient rainfall. These highlands are about 300 miles distant from Bahrein and about 3000 feet in height, giving an average gradient of 10 feet per mile to bring about the migration of the water. The isolated groups of springs on the Arabian mainland probably mark the site of gentle domes which bring the water-bearing strata to the surface.

It would be interesting to know the extent of the Eocene limestones in Central Arabia and if the horizon of the water strata is constant throughout. While at Qatar a tribesman brought me a silicified echinoid which he said he had picked up on the desert at Jaiban, about halfway between Dohah and Hasa. I have identified it as *Echinolampas Perrieri*, de Loriol, which indicates a Mokattam or Middle Eocene age.

APPENDIX II. QATAR PENINSULA

In this paper I have avoided giving detailed descriptions of itineraries; but some notes on a traverse across Qatar may be of interest in that this peninsula has previously only once been crossed by a European, namely, by Burchardt (14), and then by a different route. I journeyed from Bahrein to Dohah, the chief town of Qatar, by motor boat, landing at intervals en route. I was able to make a number of corrections on the Admiralty Chart regarding positions and names of reefs and islands along this very little-known coast. Dohah is a very prosperous, well-populated town, dependent of course entirely on the pearl trade, and it no longer deserves Palgrave's epithet, "the miserable capital of a miserable province." It has increased in size greatly during the course of the last few years—chiefly, for various reasons, at the expense of Bahrein—and many large new houses were in course of erection. I should estimate the population of the two adjacent towns Dohah and Bida at about 20,000.

From Dohah I made a trip inland to Shaja wells, 28 miles west-south-west, to visit Shaikh Abdulla bin Jasim, who spends the winter months in camp at one or other of the wells in the interior of the peninsula. The country is completely devoid of feature, natural or artificial, and is monotonous to an extreme. I tried to carry a prismatic compass traverse across, but owing to the absence of all landmarks I had to abandon the attempt as I could not afford time, nor probably should I have been allowed, to erect beacons.

The ground rises gradually and imperceptibly to 250 feet at Shaja, and is formed of a hard plateau plentifully strewn with limestone blocks derived from the almost horizontal Middle Eocene limestone sheet of which the entire peninsula from here northwards is composed. I passed four wells or groups of wells between Dohah and Shaja, and according to local report such wells are distributed throughout the district. The water is very slightly gypseous, but is quite drinkable, and is obtained at depths varying from 10 to 15 feet near the coast to 120 feet at Shaja. The quantity is quite independent of the local rainfall, so this water must have the same ultimate source as that of Bahrein. Shaikh Abdulla has recently planted gardens at Rayan, 6 miles west-south-west of Dohah, which are watered by hoist from the wells. There were formerly a number of settled villages with date gardens in this district, but under the rule of Shaikh Jasim, Shaikh Abdulla's father, they were completely destroyed, as local superstition attributed the cause of plague to date gardens. I passed one such ruined village at El Wrigba, 4 miles west of Rayan.

From Shaja I rode about 10 miles farther westward until within sight of the flat coast-line of the Dohab es Salwa to the west. I had to be content with this distant view, as the coast is inhabited by Ikhwan tribesmen over whom Shaikh Abdulla professed to have insufficient control. He would not allow me to travel farther southward, but from his description the country is flat and featureless. Sand-dunes begin to appear towards the south end of the peninsula. An ostrich egg had recently been found in one of these dunes and was shown to me. It was deeply pitted by sand erosion and had the appearance of considerable age. No ostriches are known from this part of Arabia at present.

APPENDIX III. REPORT ON THE COLLECTION OF FLINT IMPLEMENTS *by* REGINALD A. SMITH, *Dept. of British and Mediaval Antiquities, British Museum*

The flakes brought by Mr. G. M. Lees from Arabia are certainly human work, except those marked with a round white label, which are more likely

natural fractures; but neither in size nor quantity do they give any clue to the industry or industries to which they may belong. Of the chert specimens from the site indicated by L—GM 962 * the best is the largest, which recalls the cores found north-east of Baghdad as well as on the river Indus (Rohri Hills); but it would be unwise to draw conclusions from one example. There are two flakes that might have come from such a core; and the others show slight traces of use at the edges. From the other site (L—GM 651) † are seven miscellaneous specimens of chert, jasper, etc., the three smallest being splinters from a core: the others are amorphous, but one seems to be a hollow scraper, and the largest has a chisel end that might conceivably point to its use as a graver (burin). The whole series can only be regarded as a promise of better things when opportunity can be found to examine the localities more systematically; and it is well known that the desert between the Persian Gulf and the Mediterranean contains stone relics which point to considerable occupation or traffic in prehistoric times, when the climate was probably more favourable than it is to-day.

APPENDIX IV. REPORT ON COLLECTION OF BIRDS *by* N. B. KINNEAR, *British Museum* (*Natural History*)

Mr. G. M. Lees brought back from the 'Oman Peninsula a small collection of birds consisting of twenty-three specimens referable to fifteen species, which he has very kindly presented to the British Museum. This collection is of considerable interest and shows what can be done, even in a small way, by travellers in new or little-known countries. It is to be hoped that others will follow the example of Mr. Lees and help to enrich our National Collection.

There are in the British Museum a fair number of birds collected at Muscat by Sir Percy Cox, Col. Miles, Dr. Jayakar, and others, but there are no specimens from the 'Oman Peninsula, and there appears to be practically no information on the birds of that part.

Small as Mr. Lees' collection ‡ is, it contains a new bird: a geographical race or subspecies of the Sandgrouse, *Pterocles coronatus atratus*, found in Eastern Persia, Baluchistan, and Sind. This bird, of which five examples were obtained, was described by me in the *Bulletin Brit. Orn. Club*, vol. 48, No. 317, p. 11, 1927, as *Pterocles coronatus saturatus*, and differs from the northern bird in its darker colour. Strange as it may seem, specimens of the Sandgrouse from Muscat are nearer to the Baluchistan examples than those from the 'Oman Peninsula. Two other birds of special interest obtained by Mr. Lees are the Yemen Babbler, *Argya Squamiceps yemenensis*, and Bury's Grey Shrike, *Lanius excubita buryi*, both hitherto known only from the Yemen.

The remaining twelve species do not call for any special comment, and are as follows: Kashmir Redshank, *Iringa totanus terrignotæ*, Hume's Blue Rock Pigeon, *Columba livia neglecta*, Little Brown Dove, *Streptapelia senegalensis cambayensis*, Muscat Green Bee-eater, *Merops orientalis muscatensis*, North Indian Roller, *Coracias benghalensis benghalensis*, European Hoopoe, *Upupa epops epops*, Central Asian Kingfisher, *Alcedo atthis pallasii*, Baluchistan Purple Sunbird, *Leptocoma asiatica brevirostris*, Plain Willow Warbler,

* Dhofar, between Al Balad and Thaqa.

† 'Oman, near Jabal Malih in Wadi Sharm.

‡ The actual collecting was done by Mr. J. Fernandez, to whom the credit is due. As we moved camp every day he had often great difficulty in preparing and drying his specimens, many of which have suffered in consequence.

Phylloscopus neglectus neglectus, small Whitethroat, *Sylvia curruca minula*, Red-tailed Chat, *Œnanthe xanthopryma chrysopygia*, Hume's Chat, *Œnanthe alboniger*.

APPENDIX V. THE INSECTS COLLECTED BY MR. JOSEPH FERNANDEZ

The collection of insects taken by Mr. J. Fernandez in Arabia, though very small, is of great interest, the insect fauna of that country being still very little known. It is not surprising, therefore, that there are several undescribed species in the collection, but, unfortunately, most of the specimens are in an unsatisfactory state of preservation, and it was not found possible by the respective specialists to describe new species from single and damaged specimens. The collection is too small to permit any faunistic conclusions, but the African affinities of the Arabian fauna are clearly demonstrated by it once more, and the Indian elements are also in evidence, while the bulk of the species collected belongs to the highly typical fauna of the great desert belt of the Old World; into the latter category fall most of the Arabian endemic forms as well.

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DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said: This afternoon we are to listen to a paper by Mr. Lees on the physical geography of South-East Arabia. Mr. Lees has been there as geologist, but I have no doubt that he will be able to tell us a good deal of what geographers want to know, because we have never been able to draw a hard-and-fast line between

geography and geology. There are some who say that physical geography is modern geology. In any case, Mr. Lees is to speak of a country about which most of us know but little, for very few Europeans have had the opportunity of travelling in it.

Mr. Lees then read the paper printed above, and a discussion followed.

Sir PERCY COX: I am no geologist, and therefore any comments I can make will not relate to the geological aspect of the subject. I must, however, congratulate Mr. Lees on the very able way in which he gave his paper, making it of extraordinary interest to those who are not geologists as well as to any who are. I know nearly all the ground that he has shown on the screen, but am sorry to say that when I was there I did not look at the country from his point of view. I would like to ask him if the Jabal Abyadh is of the same formation as the Jabal Akhdhar. I went fairly close to the Dhofar coast in a tramp steamer, and my recollection is that from the ship there was a range in sight all the way down. Apart from the geological interest there is a good deal of importance in the photographs and anthropological information that Mr. Lees gets from Dhofar, a spot which badly needs further exploration. It was always my ambition to do that, and I hope some one will have the opportunity in the near future, especially as the Sultan of Muscat spends part of his time there and may be able to make travelling easier than hitherto. Those who have not first-hand knowledge will not realize from what Mr. Lees has said how extraordinarily difficult the conditions of travel in 'Oman are. He spoke of a not too friendly reception on the coast, but everywhere travelling is very difficult compared with any other country I have been in. Did you have to pay your way very heavily, Mr. Lees?

Mr. LEES: As a rule.

Sir PERCY COX: There you had the advantage of the backing of a wealthy institution, which the private traveller has not. The Dhofar area is undoubtedly one of great importance and interest. We had a few months ago at the Central Asian Society a paper on the location of Ophir in which the lecturer considered that he had proved to his own satisfaction that Dhofar was Ophir. A good deal of the argument he brought forward did not seem to me to advance the position, but what Mr. Lees has now told us with regard to the Sabæan ruins is interesting from that point of view. Did he when there have the question of Ophir in mind? It is possible that we might get further evidence. I knew only the northern section from Sharjah down the coast, along the edge of the desert, and there was some difference of opinion as to the position of Jabal Hafit, but I think that has been settled. Have you knowledge of the formation of Jabal Hafit?

Mr. LEES: I take it to be the same as Jabal Abyadh.

Sir PERCY COX: There is no cultivation on Jabal Abyadh. How does Mr. Lees account for the plateau of the Jabal Akhdhar being fertile and heavily cultivated, if of the same formation as Hafit and Abyadh?

Sir ARNOLD WILSON: As regards the arc, I have obtained from the Map Room the Admiralty Chart which, I presume, is the only authority which our German friends have had, and looking at it it does not seem to me that there are adequate geographical grounds for assuming the existence of this arc. Does Mr. Lees consider that the evidence on the chart is sufficiently strong to prove its existence?

Mr. LEES: There is indication of a ridge.

Sir ARNOLD WILSON: It seems to me that the very sparse soundings that have been taken could be otherwise interpreted, remembering that, as far as

I know, they were taken in the 'sixties at intervals of something like 50 miles, and that altogether in the whole area covered by the alleged arc there are less than thirty soundings. Further soundings might quite possibly show that the ridge, if it exists at all, is constructed on very different lines.

I should like to ask the lecturer if he can give any explanation as to why it is that the climate of Dhofar should be so very different from that of the northern half of 'Oman. Mokallah, 100 miles south, does not get the monsoon; Masira a couple of hundred miles north does not get it, and Dhofar does.

As regards the diorite which is, according to Mr. Lees, the commonest formation, it would be interesting to know from him whether he has been able to identify it with that found at Ur of the Chaldees. It would also be interesting to know from Mr. Lees if he got any samples of copper, and, if so, can they be correlated at all with the coinage and the copper relics that have been found at Ur? Some British Museum experts have recently made a very careful analysis of early copper relics from Mesopotamia and elsewhere, and they have, I understand, found in certain of them traces of tin, which enabled them to say definitely that the copper from which those coins were made did not come from Turkey, because the Turkish mines produce an ore which has no trace of tin. It is suggested that the Muscat ores, if analysed, might give some clue as to whether the copper came from 'Oman originally.

There is another point on which one would like to know more. Mr. Lees has propounded more problems than he solves, which is the essence of a good lecture. Can he make any deductions as to the geology of the Ruba al Khali in reference to the geology of its surroundings? He has been discreetly silent upon the geology of places he has not visited, but other geologists have been very much less so. Krenkel had not been to 'Oman, but he did not hesitate to dogmatize. I do not see why Mr. Lees should not follow his example; at any rate upon the central sands. The red colour to which he referred does not extend over the whole area. Where does the rest of the sand come from? What is its origin? What rocks are sufficiently elevated and exposed to aerial action to produce this vast mass of sand?

Finally, as regards the inhabitants, we have that most suggestive find of flint implements. Moreover, they have been found in such widely separated places as 'Amman and Megiddo, as well as near Karchemish and in Sind, and apparently there is some sort of correlation between them. Whatever it is, the finding of them suggests that early man must have had a far wider extent than we have hitherto thought. That early man should find it worth his while to go to Dhofar is astonishing. This means that at least 20,000 years ago there must have been a race with some culture in common extending over the whole of that area.

Dr. MORLEY DAVIES: It is my misfortune to know nothing whatever about Arabia. All I can contribute to the discussion are some remarks upon the general aspect of Mr. Lees' discoveries. He has certainly done a very remarkable and valuable piece of work in exploring this comparatively unknown part of Arabia, and my interest in it is largely on the tectonic side. I was very much struck, not only this evening but in listening to his more detailed account before the Geological Society, with the resemblance in the geology of parts of 'Oman with that of parts of the Alps. In the Rhaetic Alps, for example, there are most remarkable resemblances to what Mr. Lees has described in 'Oman. The only difference is that the thrust which has brought together the same different types of rock in the same association in the case of the Alps proper has been from the south, and in the case of 'Oman from the north. It had been

realized long before this that the 'Oman chain was part of the general Alpine system, in the broad sense of that term, but Mr. Lees made two very important new contributions. One is the actual definite age of the 'Oman chain, which is earlier than that of the greater part of the Alps. There is evidence in the Eastern Alps of movements about the same time as the upheaval of the 'Oman chain, that is to say, about the middle of the Cretaceous period. The great part of the Alpine movement was in the middle of the Tertiary period. The other important new point is that change in direction of the chain. Instead of running, as has hitherto been described in Suess, to connect with the chains of Sind, Mr. Lees shows it bends south-east and disappears in the ocean. What becomes of it there he does not know. That is a problem he has set for future geologists to determine.

I need not add to what Mr. Lees has said as to the bearing on tectonic questions which are associated with the names of Wegener and Argand. Those who have looked through Argand's remarkable work on the tectonics of Asia which he contributed to the Geological Congress at Brussels some years ago must necessarily feel that such a big attempt at determining the tectonics of an enormous area not only in Asia but adjacent parts of other continents, so much of which is still only partially explored, is not only a very grand attempt but a very dangerous attempt ; and when a geologist like Mr. Lees points out that the direction of mountain chains in one corner of Arabia is very different from what has hitherto been supposed, it makes a considerable difference to these grand schemes. Mr. Lees has certainly put a problem for future consideration by tectonic geologists. I certainly think the sciences of geology and geography are to be congratulated upon the opportunity that Mr. Lees has been given of exploring this district, and the Royal Geographical Society is also to be congratulated on the way in which he has put the results before its members.

Prof. J. W. GREGORY sent the following note, which was read by the Secretary :

I am glad to offer my congratulations to Mr. Lees on the high importance of his recent work on the geography and geology of 'Oman. It has been obvious from the position of the 'Oman Peninsula that it might prove of special significance in relation to the Persian Mountain Arc and the history of that part of the Indian Ocean known as the Arabian Sea. The work of Mr. Lees, in conjunction with that of his colleagues in the Anglo-Persian Oil Co., has proved for the mountains of 'Oman and the adjacent part of the Persian front almost the same sequence of events as in the Eastern Alps. One unquestionable advance in the recent knowledge of Swiss geology has been that the Alps are due to a prolonged series of movements, and not to upheaval in one geological episode. The same fact has now been proved for the mountains beside the Persian Gulf, and the discovery in 'Oman of great overthrust sheets due to movements in Middle Cretaceous times strengthens the relations between the Persian Arc and the Alps. The points in common between those mountain chains now prove to be so numerous and important that instead of regarding the Persian Arc as analogous with a southern offloop from the Alps it should perhaps be regarded as the continuation of the main Alpine Chain. Mr. Lees has also shown that in this part of the great Asiatic mountain system, as in part of the Alps, the earlier (*i.e.* Middle Cretaceous) Earth-movements, were the most intense, and those of the period to which the main upheaval of the Alps was formerly attributed were relatively gentle.

The obvious former extension of the 'Oman Mountains into the Indian Ocean indicates the formation of that part of the ocean basin by subsidence in modern

geological times. The Argand-Wegener conception that this part of the Indian Ocean is the hollow left by the drifting apart of India and East Africa is difficult to reconcile with this great zone of compression which Mr. Lees has so clearly described in 'Oman. The evidence seems to me all in favour of the former continuation of the 'Oman Mountains across the site of the Indian Ocean to the mountains of Western India, as advocated by Mr. Lees, and not along the alternative southward route that has been suggested.

Mr. G. M. LEES: Sir Percy Cox referred to the difficulties of travel in 'Oman. It is for the most part independent tribal country, and the difficulties lie largely in the preliminary arrangements. If the chief of a tribe offers one the hospitality of his country it becomes a point of honour with him to see one safely through. Without his consent one simply cannot go.

The supposed submarine ridge between Ras al Hadd and Sind is not very definite. The soundings are insufficient to establish the point, and at the most the ridge is very gentle. There are, however, independent geological points of evidence which support the connection of 'Oman with Sind in a simple arc by the late Tertiary movements.

I can offer no adequate explanation why only Dhofar should receive regular summer monsoon rains. The coast in either direction is comparatively barren, although the hills are in places as high or higher than at Dhofar.

I am grateful to Sir Arnold Wilson for drawing my attention to the question of the origin of the diorite found at Ur. I shall make a point of examining these objects at the British Museum. Copper occurs in several places in 'Oman, but rarely traces of tin, and then not in association with the copper. I examined several old copper workings, but I was unable to find any evidence of their age.

It is very tempting to speculate at this distance on the nature and reason of the great sand desert, especially as what one says is not likely to be contradicted for many years to come! I have stated in the paper that the sand is probably derived from an older sandstone formation, perhaps the Murbat sandstone in the south or the sandstones of the Hormuz Series farther to the north-east.

In conclusion, I should like to thank you for the patient way in which you have listened to a recitation of dry facts about a very dry country.

The PRESIDENT: Mr. Lees has just thanked us, but before thanking him I should mention that a letter has been received fron his geological chief in England speaking in terms of high praise of Mr. Lees and his work, of his capability, thoroughness, and absolute fearlessness. I was interested to hear what Mr. Lees said with regard to the Wegener hypothesis as well as the comments of Dr. Morley Davies and Sir Arnold Wilson. I am sure you would wish me, in the name of the Society, to thank Mr. Lees for his valuable contribution to the information which we possess on South-Eastern Arabia.

MOUNTAIN CLUBS FOR THE HIMALAYA

FROM time to time during the past forty years travellers and explorers have suggested that the foundation in India of a Society with objects akin to those of the Alpine Club would be likely to prove of invaluable aid to geographical and scientific exploration of the great ranges of Central Asia. But to those on the spot, to Anglo-Indians, there seemed many obvious and practical difficulties in the way of carrying out any such suggestions. Himalayan exploration, it was alleged, demands both more time and expense than the average Englishman in India can afford ; distances are great and transport is onerous ; guides and porters, in the Alpine sense of those terms, have to be created. And after these difficulties had been faced and overcome there remained always frontier barriers and official restrictions, liable to be strictly enforced by an unsympathetic Secretary of State.

Yet before the end of the War there had come a perceptible change in the atmosphere. The lapse of years had brought with it not only a series of important scientific expeditions by travellers or Survey Officers into the previously unexplored wastes of the Karakoram beyond Kashmir, but incursions by wandering sportsmen or Members of the Alpine Club into different regions of the Himalaya, in Kumaon, or Sikkim, or Gharwal. General Bruce had spent the best part of a lifetime in training his Gurkha soldiers and making them expert snow- and ice-men. Mountaineering was in the air, not only in official circles but in the highest quarter. Already, in 1905, Lord Curzon, during his Viceroyalty, had written to Mr. Freshfield asking for his services at home in securing the joint support of the Royal Geographical Society and the Alpine Club for an attack to be made on Mount Everest under official auspices. Thwarted at the time by the objections of the Nepalese Durbar and the strained condition of our relations with Tibet, it was not till 1921 that Lord Curzon was able to see his project put into execution. It was inevitable that the three years of dramatic conflict between Man and Mountain which ensued should be watched with the keenest interest by our countrymen in India, and that as a consequence its tragic end should have stirred their minds in the direction of some action commemorative of so heroic an adventure.

No form of memorial, we believe, could have been adopted more appropriate or more welcome—not only to the friends of all who took part in the late assaults on Mount Everest, but to all travellers and mountaineers—than that which has been chosen simultaneously at Delhi and Calcutta. It has taken the shape of the formation of Societies whose primary object is to be that defined in the Rules of the present Alpine Club—the promotion of mountain climbing and mountain exploration, and of a better knowledge of mountains through literature, science and art.

For the following particulars as to the two Indian bodies in question we are indebted to their respective Honorary Secretaries—Mr. Allsup and Major Kenneth Mason.

In order of date the first Club to be founded was that started at Calcutta, with the title of "The Mountain Club of India," under the Presidency of General Bruce. It already numbers some seventy members, mostly residents in Calcutta. General Bruce informs us that it owes its inception mainly to the energy of Mr. Allsup, who has taken infinite pains in its organization. In the Sikkim Himalaya it should find a readily accessible field for exploration. There its members may see to the opening and improvement of paths to the glaciers, fill in the gaps in Prof. Garwood's map, and emulate the feats accomplished by the late Dr. Kellas with no aid but that of native guides and porters.

If it can succeed in establishing a substantial refuge near the head of the Zemu glacier, the long eastern spur of Kangchenjunga and the base of Siniolchum might be fully investigated.

Unconscious of the movement at Calcutta, steps were being taken about the same time in influential quarters at the seat of the Government at New Delhi to start a Himalayan Club which should have all the advantages of official and departmental support and sympathy, and might through its branches and its relations to the Survey hope in time to cover the whole of Northern India. The Commander-in-Chief, the Governor of the Punjab, and the Surveyor-General were amongst those who supported the project and agreed to become Founder Members. In this state of affairs the active promoters of the Delhi Himalayan Club, Sir Geoffrey Corbett and Major Kenneth Mason, met and engaged in friendly conversation with the Secretary of the Calcutta Club. They agreed that there was plenty of room for both bodies, and that while the Calcutta Club was not in a position to deal adequately with the Himalaya as a whole its independent existence would, at any rate for the present, be an advantage to the common end in view.

The next formal step to be taken was the issue at Delhi on December 20 last of a circular letter signed by Sir G. Corbett and Major Kenneth Mason proposing that a Himalayan Club should be formed "with the object of assisting Himalayan travel and increasing our knowledge of the Himalaya in all its aspects, and with a scope not less wide than that of the Alpine Club." The promoters pointed out that, "apart from the assistance that such a Club would give to its own members, it might be of great value to the Survey of India, to the Geological Survey and other scientific departments, and also from the point of view of military intelligence and training in mountain warfare," adding that they had been informally assured of the interest of the Departments of Government principally concerned. The headquarters of the Club it was proposed should be at Simla. In conclusion they referred to the formation of the Mountain Club of Calcutta and expressed a cordial

hope that the two kindred bodies might cooperate, if not coalesce, in the future.

The circular above quoted was followed on February 17 last by an Inaugural Meeting of the Himalayan Club held at Delhi, at which the Chairman, Field-Marshal Sir William Birdwood, was nominated the first President of the Club. The following officers were elected: Vice-Presidents, Major-General K. Wigram and Colonel Commandant E. A. Tandy. Sir G. Corbett was appointed Honorary Secretary, and Major K. Mason Honorary Editor. Local secretaries were appointed for Kashmir and Kumaon, and correspondents for Lahore, Razmak and Peshawar.

Sir F. Younghusband and Mr. D. Freshfield were invited to become Founder Members. Mr. Freshfield has also accepted the Honorary Membership of the Calcutta Club.

The Club was assured of the sympathy of the Viceroy and the support of the Heads of the various Departments. Starting under such favourable auspices we may feel confident that the newly formed Clubs will prove equal to their task and do much to add to our knowledge of the greatest mountains in the world. D. W. F.

A REGIONAL MAP OF THE EARLY XVITH CENTURY

E. G. R. TAYLOR

WHEN the sequence of symbols employed to represent orographical features on a map is studied, it is seen that the reduction of such symbols to the almost meaningless convention current before the introduction of modern hachures and contours was the work of the great cartographers of the Flemish and Dutch Schools. Many of the maps drawn in the late fifteenth and early sixteenth centuries give a vivid, if rough, interpretation of the relief of the land, such as is entirely wanting in a map of Ortelius or Mercator.

The usual method of indicating the topography was by a semi-pictorial representation of mountains or hills; but a fifteenth-century map of Italy, very similar to that in the Berlinghieri rhymed Ptolemy of 1478–80, shows the elevated land by means of a linear outline and a shaded wash of brown. The same convention is employed in the maps of Italy and Umbria in a Florentine MS. Ptolemy of about the same date. In the absence of a colour wash, the device of emphasizing the edge of the uplands by a combination of hill-shading and hill-foot outline was sometimes employed with good effect. A map of the latter type forms the subject of the present notes.

Of the many early printed editions of the Text and Maps of Ptolemy's Geography, that issued from Strasbourg in 1513 is of particular importance, on account of the remarkable collection of twenty Modern Maps—*Tabulæ Novæ*—which it contains. Such maps had, indeed, appeared in earlier editions, but they were few, while the Strasbourg Ptolemy included among them a group of relatively large-scale regional maps—termed Chorographical—which were drawn with surprising accuracy, and are of unique interest for the skilful delineation of landforms. The maps that particularly attract attention are those of Lorraine, and of the Rift Valley of the Rhine, while the general map of France is also very striking.

With regard to the Rhine maps, a point worth emphasis is the selection by the cartographer of a definite physical, as opposed to political, unit. The area embraced is the trough from Basel to Bingen, with the full width of the bordering block mountains, their parallel escarpments being carefully emphasized. The Rift Valley is, of course, so remarkable a natural geographical unit as to be very easy of recognition, yet the successors of the cartographers of 1513 failed to recognize it, or at least they failed to place it in recognizable form on their maps. This can be confirmed by an examination of the map of Europe of 1553 assigned to Natalis Bonificius; the large-scale provincial maps of Mercator; those of Ortelius, and so on. Another morphological entity which stands out on the older and disappears on the newer maps, is the "Bohemian Diamond," which the modern maps re-discover.

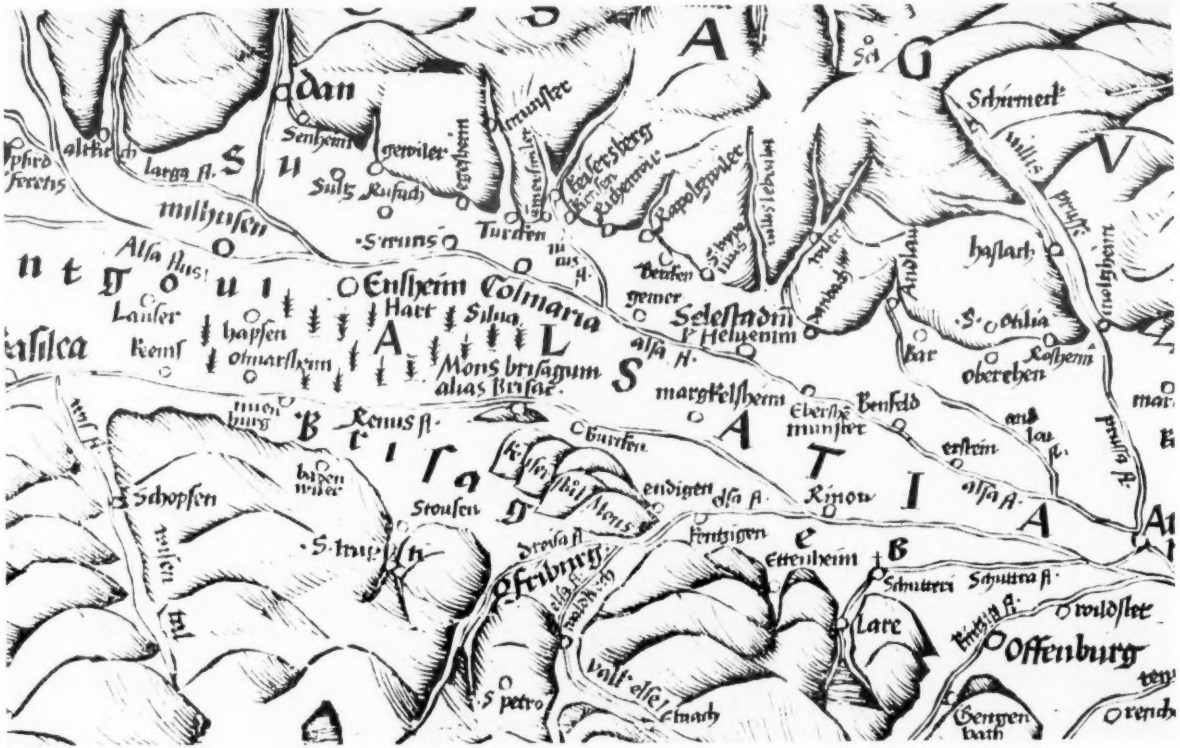

Plate 1. *The Upper Rhine valley from Waldseemüller's map in the Strasbourg Ptolemy of* 1513

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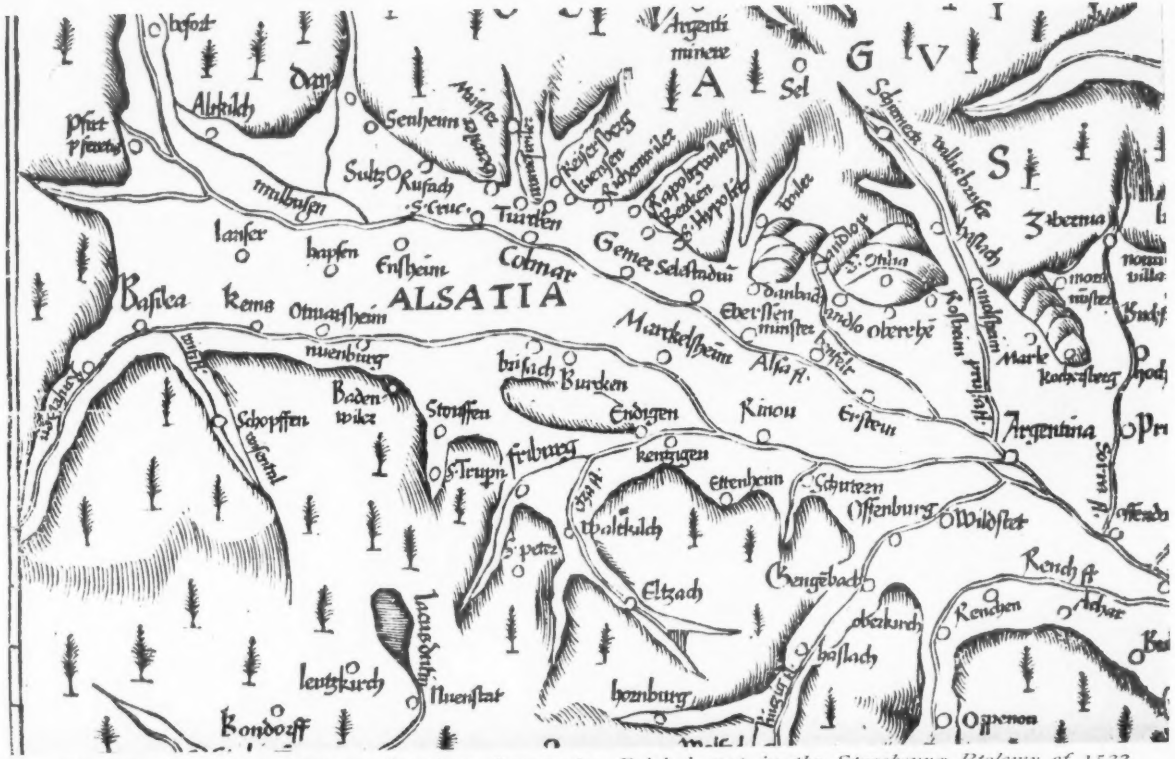

Plate 2. The Upper Rhine valley from Laurentius Frisius' map in the Strasbourg Ptolemy of 1522

The excellence of the map of the Upper Rhine of 1513 is due, undoubtedly, to its being the work of men who had a first-hand knowledge of the district: it is the result of a survey, and not merely a compilation. This is in harmony with the conclusion, reached from quite other considerations, that the Strasbourg Ptolemy of 1513 was produced under the direction of Waldseemüller, and embodied material collected by the geographers of St. Dié for the edition they had planned to issue from their own press. As regards their local knowledge, Waldseemüller was born at Freiburg-im-Brisgau, about 1475, and was educated at Freiburg University: he was Canon of St. Dié in 1507, and is known to have been in Strasbourg in 1513. His colleague Ringman (who died in 1511) was born in the Vosges, educated at Heidelberg, and became Lecturer in Cosmography at Basel. The patron of St. Dié was René II of Lorraine, for whom the striking regional map of that area was made, probably just before his death in 1508. Waldseemüller is best known for his world maps of 1507 and 1516, but he also made in 1511 a road-map of Europe (*Carta Itineraria Europæ*), which is referred to by Ortelius in his list of authorities consulted. The editors of the first Strasbourg Ptolemy were Aeschler and Ubelin, and the only name attached to the maps is that of the printer and publisher, recorded in the inscription: *Opera Ioannis Schotti Argentinen̄. Anno Christi opt. max.* 1513. Comparison of the relevant maps with the signed *Carta Itineraria*, however, leaves no doubt that both are by the same hand.

Schott, although a citizen of Strasbourg, moved his press for a few years to Waldseemüller's birthplace, Freiburg, where he published the first edition of Reisch's *Margarita Philosophica*, accompanied by a Ptolemaic world-map. This work was immediately "pirated" by Johann Reinhard, known as Grieninger, the great Strasbourg publisher, who issued an edition in 1504, which Schott promptly followed by a second "authorized" edition from Freiburg. Now Grieninger was the general publisher for the St. Dié group from 1507 onwards, and its members were associated in various ways, the significance of which will appear later, with his 1508, 1512 and 1515 editions of the *Margarita*. Schott's third edition of this popular work was issued from M. Furter's press in Basel in 1508, after which he returned to Strasbourg and issued the Ptolemy in 1513.

A second edition was called for in 1520, so that the demand must have been great, and Grieninger planned to issue an edition in his turn. Waldseemüller, however, had meanwhile died, and an editor was found in Laurentius Phrysius or Frisius, a mathematician of Metz, under whose supervision the Grieninger Ptolemy appeared in 1522. The cartographical skill of Laurentius Frisius, as shown by the initialled *Carta Marina* which he drew for the new Ptolemy, and by his large world map, drawn in 1525 and published by Grieninger in 1530, was very inferior to that of Waldseemüller. He contented himself for the most part with

Plate 2. The Upper Rhine valley from Laurentius Frisius' map in the Strasbourg Ptolemy of 1522

redrawing the latter's maps on a reduced scale for the new work, and as an example of his careless workmanship it may be mentioned that in preparing the map of Further India, he enlarged the Scale of Miles, while reducing the map itself! *

Although most of Laurentius Frisius' deviations from Waldseemüller's maps were for the worse, he did, in redrawing the Rhine Valley map, make two improvements: the Vosges and Black Forest massifs were simply blocked out by means of a hill-foot line combined with hill-shading, the actual sketches of mountains on the original being eliminated; further, a uniformly spaced symbol, in the shape of a conventional conifer, was substituted for the realistic tree-clumps of the original. The result was a much clearer map from the point of view of morphology, and portions of the two maps are shown in Plates 1 and 2, while the same area as given in Ortelius is shown in Plate 3. Since, however, there was loss of accuracy (here, however, under 2 per cent.) in the redrawing, the measurements that follow were made from the original map.

Brief reference may first be made to the two other specially notable maps drawn for the 1513 Edition. The general map of France occupies a double page, and is on the scale of 1/2,750,000. As in the case of all maps of the period, its accuracy is vitiated by the acceptance of 60 Italian or 15 German miles as the linear measure of a degree. Measurements from north to south were adjusted to observed latitudes, while in the absence of observed longitudes no such false adjustments were made of direct measurements from east to west. Consequently the actual scale of the map from north to south is 6/7 (approx.) of that from east to west. This map of France bears evidence of having been compiled from regional maps, *e.g.* the Lorraine area, as shown by the inverted place-names, is clearly drawn from a map oriented with the south at the top, as is the Lorraine regional map in the Atlas.

The regional map of Lorraine (King René's map) was drawn on a scale of 1/690,000, as calculated from the attached scale of miles. Degrees of latitude are marked on the margin, but there is no attempt to show longitude. This map is typographically interesting as being the first map known to have been printed in colour (black, red and brown). It is also in colour in the 1520 edition, but when redrawn for Grieninger was printed only in black.

The full title of the regional map of the Rift Valley of the Rhine is *Tabula Nova Particularis Provincie Rheni Superioris*. It is drawn on a scale of 1/507,000. The orientation is with the west at the top of the double page, degrees of latitude being marked along the bottom or

* The Grieninger-Frisius Ptolemy was reprinted in 1525, and the same map-blocks were used for the Lyons edition of 1535, edited by Michael Servetus, and published by the Brothers Gaspar and Melchior Trechsel: the blocks were used yet again for the Vienne edition of 1541.

Plate 3. The Upper Rhine valley from 'Basiliensis Territorii Descriptio Nova, auctore Sebastiano Munstero' in Ortelius' 'Theatrum,' 1573

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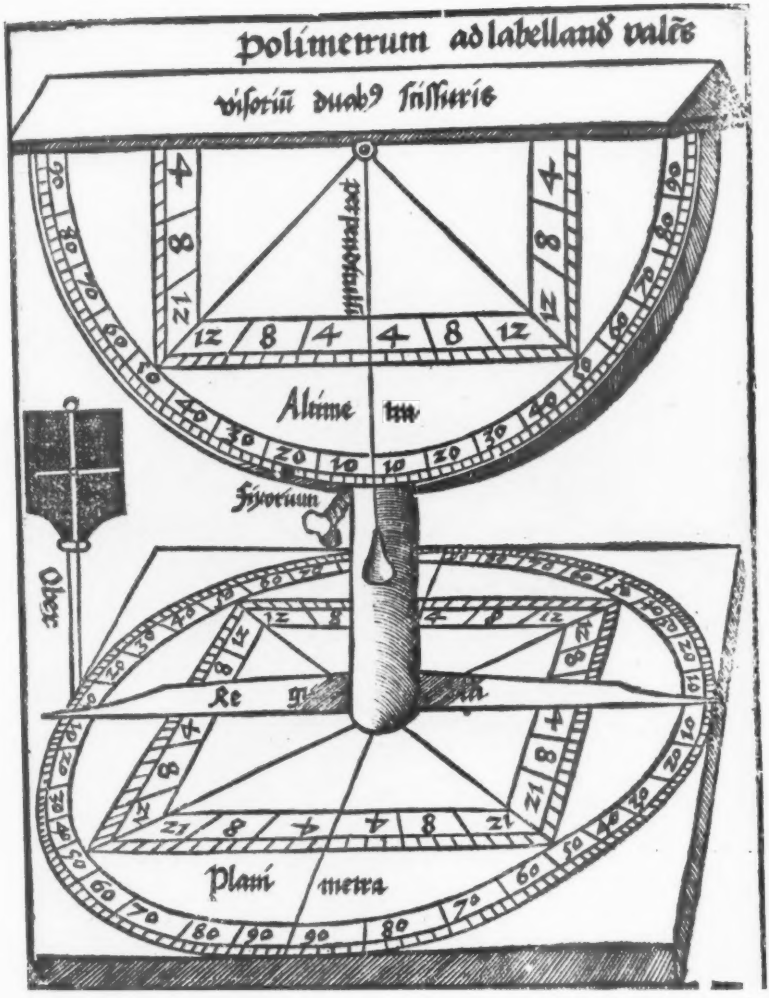


Plate 4. *Waldseemüller's Polymetrum, from Reisch's 'Margarita Philosophica,'* 1512

eastern margin. The binding of the R.G.S. copy of 1513 makes this map easier to study in the 1520 edition. The redrawn (1522) map is on a scale 0·78 that of the original, which reduces the representative fraction to 1/649,000, and makes the scale of the degrees of latitude roughly 1/750,000 owing to the error already mentioned. Comparison with the map of the same scale in Andrée's Atlas brings out very plainly the high degree of general accuracy of the older map. The valleys penetrating the Black Forest are particularly well brought out. As bearing on the provenance of the map, it may be noticed that the boundary is drawn so as to include S. Deodatus (St. Dié), and that the small head-streams of the Meurthe, on one of which the city stands, are unusually carefully drawn.

The use of a special convention for the hill country of the Palatinate, and for certain spurs of the Vosges, appears to be deliberate, and to indicate lower and more broken uplands, as opposed to a more massive type. Features outside the Rift Valley and its borders (save those of Lorraine) are often merely sketched in, rather than carefully mapped. Thus by a curious error, the river Wutach, rising in Titisee (Lake Dutin of the map), is made to join the Danube, from which indeed it has only been diverted by a (geologically) recent capture. The river Nahe is generalized so as to bring out the trend of the southern scarp of the Hunsruck, but the drainage of the Hardt uplands in the Palatinate is over-schematized, for although it is radial, and Kaiserslautern does stand at a hydrographical knot, the rivers do not rise from a common spring as shown on the map. The scanty place-names in this particular area also suggest lack of material.

The most obvious fault of the map, namely the great eastern bend of the Rhine about lat. 49°, turns out to be due to mapping separately the areas north and south of this parallel, with subsequent faulty dovetailing.

A study of the latitudes of the most important towns, as measured directly from the map, reveals such a surprisingly high degree of accuracy that it is clear that a large number of astronomical observations were used. These latitudes have been tabulated side by side with those taken from the Times Atlas or Andrée's Hand-Atlas, between which there are discrepancies up to 1′. Where possible there were also added the latitudes given by Peter Apian and Gemma Frisius, who were working twenty years later than Waldseemüller, and those by Mercator (or measured from Mercator's provincial maps) recorded towards the close of the century, fifty years later still. In practically every case the values as read from the 1513 map are the most accurate.

No longitudes are marked on the Strasbourg map, but I have calculated longitudes of the chief towns, obtained by measuring the linear distance of each east or west of Colmar for the part of the map south of lat. 49°, and west of Heidelberg for the part of the map north of this latitude. The accuracy indicated in my Table II must be put down to accuracy

of direct measurement, and the general result of the analysis is to confirm the statement *Ad Lectorem* of the cartographer himself: " . . . didiceris in his (tabulis) veram cœli latitudinem observatum. Regionum quippe longitudinem scrutari laboriosum est valde. Hinc variam causat situationem dimensio quoque varia."

For the purposes of my Table III the longitudes as measured on the two parts of the map were adjusted to Greenwich meridian, taking Colmar as 7° 21′ E. for Series C, and Heidelberg as 8° 42′ E. for Series D. Actually there is an error of 11′, practically an inch on the map, between the longitudes of Colmar and Heidelberg, although the north and south parts of the map are each fairly accurate within their own boundaries. It would appear that in order to fit distances measured by road into the too short north to south scale, the direction of the roads was distorted, and they were given too great a length from east to west or *vice versâ*.

The configuration of the valley naturally lent itself to the use of itineraries, and by comparing the 174 place-names on the map with a modern road-map, it was easy to sketch out the network used. My Table IV shows the distances measured stage by stage along the Kinzig Valley route, as compared with the distances measured on the 1/500,000 map. Although the average error is only 5 per cent, the error in particular stages is very much greater, and this is hardly to be wondered at, since milestones, if any, were very irregularly spaced, and the windings of the road had to be allowed for. But to account for the accuracy of the map in many respects, it is reasonable to suppose that some other method of fixing position was used where possible. This appears to have been the method by bearing and distance, to which the flat-floored rift valley admirably lent itself: from the cathedral town of Strasbourg, for example, or of Mainz, the spires of many towns and villages are visible, and over comparatively short distances it was possible to remeasure the roads, or to apply the method of proportional triangles. To test the validity of the assumption that such a method was used, measurements of compass bearings, and in some cases distances, were made upon the 1513, and upon a modern, map. The results, shown in my Table V, are close enough to indicate that the assumption was correct.

The next step was to ascertain what instruments were available for such observations. Waldseemüller's *Carta Itineraria* has a compass rose, with the variation marked, drawn on the lower margin, and in the booklet accompanying the map he explains how, with the map and the " compass-clock " of the period, the mutual bearings of towns can be ascertained. This fact gives strong confirmation of the suggestion that mutual bearings were used in compiling the map. So far as known, the first printed description of the instrument which Leonard Digges says was called " *theodolitus*," is to be found in a treatise on position-finding published by Gemma Frisius in 1533. Consisting of a graduated horizontal circle with a sight rule pivoted on the centre, it was, according

to the Dutch author, to be used for determining position by intersecting rays, a method he claims to have invented. In the *Margarita Philosophica* of 1503, however, there is pictured a "geometrical square" with a pair of fixed sights on one edge, and a second pair on the movable arm, which (with a compass) would serve the simpler purpose of determining mutual bearings. Waldseemüller, however, proved to have something better than this, no less than the prototype of Digges' "Topographical Instrument," and thus the actual original of the true theodolite. This instrument, called *polimetrum* (see Plate 4), appears in the 1512 edition of Reisch's *Margarita Philosophica*, facing the text of Waldseemüller's treatise on Architecture and Perspective, which first appeared (although without this block) in Grieninger's 1508 edition.

It was probably through Orontius Finæus' editions of the *Margarita*, and through de Rojas' account of Gemma Frisius' work brought to England by John Dee, friend of the younger Digges, that Leonard Digges became familiar with the surveying instruments and methods of the Continental geographers. His *Pantometria* is the treatise on the "flowers of the Sciences Mathematicall" hitherto "locked up in strange tongues" which he promised to the practical man in his Preface to the Tectonicon.

The result of this close study of a Rhine map of four centuries ago is to throw fresh light on the debt of cartography to Waldseemüller. Given even the polymetrum and the geometrical square, the degree of accuracy attained must excite our wonder, and it is clear that when all the actual measurements taken had been put on paper and adjusted to the faulty degree, much close personal study of the region itself lies behind the bold but truthful representation of its main topographical features.

NOTE BY EDITOR:

Miss Taylor's paper was accompanied by six tables too extensive to print in full. They are preserved in the Library for the use of students. The results can be summarized briefly thus:

Latitudes.

1513 Ptolemy *minus* Modern: For 25 towns the average deviation in latitude is 3′·2; the mean +0′·44, the extreme range 18′.

1513 Ptolemy *minus* Mercator: for 17 towns the average deviation is 9′·1: the mean +8′·7; the extreme range 17′.

Thus Mercator's positions were *inter se* about as good as the 1513 Ptolemy, but there is a systematic difference in the latitudes of about 8′, due almost entirely to Mercator.

Similarly, Apian's latitudes are consistent *inter se* but systematically about 5′ wrong.

The comparisons for longitude give very similar results; and the tables seem to establish quite clearly Miss Taylor's conclusion that the Rhine map of the 1513 Ptolemy is compiled from original surveys very accurate for the epoch.

AN EARLY ITALIAN GLOBE

THROUGH the courtesy of its owner, Mr. R. S. Whipple, we have been able to exhibit in the Society's Museum a small silver engraved globe of Italian workmanship which has remained hitherto undescribed, but which offers certain points of interest. The globe, which is hollow, composed of two hemispheres joined internally by "bayonet" clips, measures $3\frac{3}{4}$ inches ($9\frac{1}{2}$ cm.) in diameter, and is contained in a hinged globular case apparently of contemporary date. Its authorship is explained in a Latin inscription placed in the mid-Atlantic, which runs as follows: "Paulus de Furlanis Veronensis opus hoc ex^{mi} cosmographi D^{no} (*sic*) iacobi gastaldi Pedemontani Instauravit et dicavit ex^{ti} lur Vt doctj [juris utriusque doctori?] et aurato Æquiti D^{no} Paulo michae-li Vincentino." * Paolo de Furlani was a well-known engraver and seller of maps at Venice in the second half of the sixteenth century, dated examples of his work being mostly from the 'sixties, and including a good many copies of Gastaldi's originals. One of these copies bears an inscription in identical terms with that on the globe, though the map itself, copies of which are known with dates 1560 and 1562, is constructed on the oval projection so much used by Gastaldi, and its geography is quite different (see below).

No globe by Gastaldi from which the present specimen could have been copied is now known, but on comparing its geographical details with those of contemporary maps we discover that (so far as the small size of the globe permits, and apart from mistakes of spelling) they are identical in all respects, even to the arrangement of the names, with those in the anonymous double set of gores, radiating from either pole, found in various copies of 'Lafreri's Atlas,' including that in the Society's possession.† A reduced copy of this gore-map was given by Nordenskiöld in his 'Facsimile Atlas,' where it is regarded as the work of Antonius Florianus, whose portrait appears in the top right corner as a counterpart to one of Ptolemy in the left. Taken by itself the inscription on the silver globe might seem to prove that the gore-map (or an unknown original from which it was copied) was really the work of Gastaldi, and that it is to be added to the already long list of his productions. But a record exists that Florianus, who is described on the gore-map as of Udine ("Utin."), and who belonged to a well-known family of artists, obtained from the Venetian Senate licence to print a world-map ("un suo mappamondo") in 1555;‡ and as Gastaldi was then established at Venice it is hardly to be supposed that Florianus could have ventured to bring out a mere copy of a work of his. We are therefore confronted with a difficult problem. The possibilities seem as follows: (1) that Gastaldi, like Florianus, made a set of gores exactly copied from Mercator's map of 1538; (2) that the original of the silver globe was wrongly attributed to Gastaldi by Furlani, perhaps to enhance its value in the eyes of purchasers; (3) that the special point about the map of Florianus was its method of projection, and that this

* It is to be supposed that this man belonged to the same family as the painter Marco Micheli, also of the sixteenth century, and also known as "Vicentino."

† Precisely the same general picture of the World was already given by Mercator in his double-cordiform map of 1538, on which the Florianus gores were probably based; but there is no indication that the silver globe was taken directly from the Mercator map: it follows the gores much more closely.

‡ We are greatly indebted to Prof. Almagià of Rome for this information (quoted from a memoir by Joppi in the *Miscellanea della Deputazione Veneta di Storia Patria*, vol. 5, Venice, 1881) as also for the reference to Fiorini's discussion of the Florianus gores mentioned below.

might justify his copying the geography from Gastaldi. None of these suppositions is quite satisfying, and the first seems to be negatived by the similar arrangement of the place-names on the silver globe and the gores.

The following consideration also seems to forbid the attribution of the silver globe, or its prototype, to Gastaldi. The map mentioned above as copied by Furlani in 1560–62, but of which the original may have been made a few years before, is one of the earlier type of Gastaldi maps in which Eastern Asia is joined to North America. This idea had been discarded by the cartographer by 1562, as we learn from the letterpress then written to accompany a large world-map, of which the original issue is now unknown. From this time on Gastaldi showed the two continents as separated by a narrow passage only—the famous Strait of Anian—in the known maps assignable to him. In the silver globe (as in the Mercator map and the "Florianus" gores) there is a much wider sea between the two continents, in which it agrees with neither of the known types of Gastaldi maps.

No specimen of the Florianus gores mounted as a globe (the diameter of which would be a little over 10 inches) is known at the present day; in fact it was held by Fiorini (*Bollet. Soc. Geogr. Ital.*, Ser. iii, vol. 7, p. 416, 1894) that their construction made them unsuited to the purpose. As the single gores cover only 10° of longitude and the sections from pole to pole are broken at the equator, no fewer than seventy-two separate pieces would have to be pasted on the surface of the globe, if so mounted. Yet that this was the intention seems indicated by the presence of a scale of degrees at the equator in only one of the two radiating series of gores, while the narrowness of the segments would facilitate their adjustment to the globular surface in spite of the unsuitable projection.

The inscription on the silver globe might be taken to imply that it was actually engraved by Furlani, but such a conclusion is probably incorrect. In the Stadts Museum at Amsterdam there is a minute globe, of which photographs have been kindly given us by Mr. G. H. Baillie. This is likewise hollow, being made to enclose a watch in one half (the work of Henry Sebert of Strasbourg, an otherwise unknown maker) and a sun-dial in the other. Mr. Baillie says that the watch must be dated *ca.* 1620, yet the outer surface of the globe bears the date 1552 and a maker's name evidently intended for François de Mongenet, several of whose known globes are of the same year, 1552. (By a curious coincidence their geography shows considerable resemblance to that of the Furlani-Gastaldi globe.) It is highly probable that the watch-maker took one of these as his model, copying it exactly even to the original date, and something similar may have happened in the case of the Furlani globe, which may also have been made to contain some instrument or other object. Some support for this guess may be found in an indication of unintelligent copying in the inscription above quoted. In the oval map of 1560–62 the name Michaeli begins near the end of a line and the last two letters are carried over to the next for want of space, the first line ending with a hyphen. Now in the silver globe, although there is space for the whole name in the one line, the hyphen before the last two letters is retained, and the conclusion seems obvious that the engraver had before him a globe with an inscription arranged as in the known map of 1560–62, for the hyphen could hardly have been so placed by the original maker. The corrupted form of many place-names points in the same direction. The exact date of the silver globe must thus remain uncertain, but in any case it may be supposed to fall within the period when the original of such a globe was in common use. E. H.

REVIEWS

LES ÎLES BRITANNIQUES. Par ALBERT DEMANGEON. (Géographie Universelle. Tome 1er Publiée sous la direction de P. Vidal de la Blache et L. Gallois.) *Paris: A. Colin* 1927. 11×8 *inches;* viii+320 *pages; illustrations and maps. Francs* 80

A quarter of a century has elapsed since Sir Halford Mackinder published his 'Britain and the British Seas,' and during this time no comprehensive study of the British Isles has appeared. Since that pioneer work was done, Human Geography has won for itself a place in all the great Universities of the world, and masses of new geographical material are poured in day by day to the reservoirs of knowledge we already possess, to correct or amplify our conceptions of geographical conditions. The Great War, although this country had no devastated areas to restore, has profoundly altered the industrial and commercial outlook of the country and to some extent its financial position. It has hastened the development of tendencies which were already beginning to show themselves in our economic life. It has changed to a marked extent the outlook and habit of life of large sections of the people. Property has changed hands more rapidly and has had a much wider distribution. The small freeholder is multiplying. The development of industry in foreign countries, new inventions and changing fashions have altered the relative importance of commodities and industries and in some cases profoundly affected our markets. Electrification of suburban railways and the invention of the internal-combustion engine have revolutionized our transport and have tended, perhaps more than any other factor, to alter the face of the land. Southern Ireland has become a separate entity, so that we too have new boundary lines and customs lines to consider.

It was high time, then, that a new work should deal with the geographical aspect of all these changes and developments, and we may congratulate ourselves that the work—no easy undertaking—has fallen to a geographer of such high repute as M. Albert Demangeon.

The broad facts, the big ideas, stand. M. Demangeon follows Sir Halford Mackinder in the main divisions of his study, although the arrangement is a little different. The geographical argument is accepted to-day, and there is no longer need to demonstrate, at each step, the geographical method. This means that more space is available for the development of the argument and for a richer illustration and more detailed description. M. Demangeon's clear, crisp style admirably seconds his power of seizing upon essentials and of drawing into the circle of consideration the greatest possible amount of relevant material.

The first four chapters, some eighty pages, are devoted to general physical descriptions and correlations. The second part of the book deals with the regional and human geography. Wales, South-West England and—curiously perhaps—South England, "L'Angleterre du Midi," are accorded separate chapters.

The historical side of the subject is not neglected. Here M. Demangeon's main theme would appear to be the rise into power and prosperity of England as typical of Western European development. International exchange, he says, is the quintessence of European civilization, and Britain is the most purely European of all nations. Thus Britain flourished because she exhibited the development of this civilization in the highest degree. Now that other nations are increasing their economic activities British ascendancy is on the wane. The extra-European nations are also bestirring themselves, and the

repercussion is felt in all Europe and in England in particular. The Pacific, upon which the continents until recently turned their backs, is becoming a mediterranean sea—from which Western Europe stands apart.

It is perhaps unfortunate that the book, greatly as it is needed, could not wait another year, or even two, for publication, for European conditions are still far from stable, and the 1927 figures are the first published since the War that are of much value for estimating normal conditions, and even these have to be considered in the light of the abnormal conditions of 1926. We may not have turned the corner, but our national position is not quite so parlous as our friends appear to fear. The Port of London, for instance, reports a record year. Wiedenfeld's gloomy prognostications show no signs of being fulfilled. M. Demangeon is wisely cautious, but obviously hampered. It must be admitted that English geographers have done little to lighten his task. When we consider the innumerable studies on France and sections of France, from various points of view, that have appeared in the last twenty-five years, the work published on the British Isles appears very meagre. It is all the more surprising that one of the best geographical studies on South-Eastern England that exists—Hall and Russell's 'Agriculture and Soils of Kent, Surrey and Sussex,' 1911—should not be mentioned. 'The Economic Geography of Wales,' by Cundall and Landman, 1925, is a careful and reliable study, and Dent's 'Hampshire Gate' contains useful material. It is a pity that the census figures were not checked. Croydon is credited with ten thousand too few inhabitants, Romford with four. Harrow had a population of 19,400, not 10,000, at the last census, and the estimated population in 1926 was 21,700. An inhabitant of Oxford might wish that the statement "But for the students, Oxford, like Cambridge, would be only a dead city," were still true. Londoners will probably jib at the remark that the aspect of London can be described in two words: monotony and immensity; and some of us find it difficult to see in what the "economic servitude" of Ireland lies to-day. It is difficult to see ourselves as others see us!

Whatever the minor criticisms one might make, however, the general impression that the 'Îles Britanniques' leaves on the mind is one of real satisfaction in a masterly piece of work. The pleasant get-up of the book, the clear, efficient maps, and the beautiful photographs add greatly to the pleasure and profit of handling it. H. O.

GEOGRAPHIE POLITIQUE ET GEOGRAPHIE DU TRAVAIL. Par J. BRUNHES et P. DEFFONTAINES. (Histoire de la Nation française. Tome II. Géographie humaine de la France. 2e volume.) *Paris: Plon-Nourrit et Cie* 1926. 11×9 *inches;* 652 *pages; illustrations, maps and plans. Francs* 65

The first of the two volumes on the geography of France treated principally the physical and regional geography of the country. The present volume completes the introduction to the history of France and treats entirely of the works of man. In the first section the authors discuss the origin and growth of towns, especially Paris and the great seaports, the distribution of castles and churches, as foci of human concentration, and the course of great routes. There are also long chapters on the strategic geography of the frontiers. The chapter on Paris is an illuminating commentary on the history and growth of the town and a fine example of civic interpretation. There follows a chapter on the spirit of the great regional centres of France which is really a rider to the regional division of France discussed in the first volume.

In the study of towns the authors show the tendency that towns had to rise

and grow in marginal zones between areas of different character and diverse production. Thus in Flanders the edge of the chalk plateau of Artois is marked by Guines, Ardres, St. Omer, Lillers, Béthune and other towns. Lille is typically such a town between the dry chalk region to the south and the swampy region to the north. Seaports are another type of these marginal towns, and France is rich in seaports even though the bulk of her trade passes through only a few. Valleys were frequently avoided by routes, and hence a notable lack of towns on confluences of rivers except on certain navigable streams. Otherwise river towns were due to breaks in transport and arose where routes crossed rivers.

The chapters on seaports raise several matters of interest, such as the steps in the evolution of Le Havre from a naval to a commercial port and the changes in its commerce, the tendency to lose its imports of cotton and wool, to gain a trade in petroleum, and to increase its interests in the French colonial possessions, becoming more and more of a manufacturing centre. Marseilles has peculiarities of its own. In spite of its position in a corner of the country it handles a greater volume of tonnage than any other French port. This busy port relies mainly on local manufactures, for which it draws its raw material from far and wide. No port has worked so much for its own interests or been so little linked to the needs of France as a whole. But now Marseilles has entered on a new stage of development. The cutting of the Rove tunnel, the project to use the Etang de Berre as a kind of supplementary port and the closer links with the general streams of French traffic *viâ* the Rhone are robbing Marseilles of its isolation and bringing it more into line with other French ports.

The second half of the book treats fully of the social geography of the various environments of the country, and is a sequel to the details of the economic geography contained in the first volume. Among many matters of interest may be mentioned the graphs showing the intensity of rural work throughout the year in various typical regions chosen to illustrate different kinds of climate and agriculture. There is also a discussion on the regional distribution of games and customs.

The book, in fact, contains so much that only a few of its matters of interest can be mentioned. The whole treatment is explanatory and interpretative rather than descriptive and statistical. It embraces the essence of French geography without the detail to break the line of reasoning or detract the reader from the main theme. The book is another example of the many brilliant monographs that have come fron French geographers in recent years and must take its place as the standard work on the geography of France. Incidentally it supplies a complete justification of the geographer's contention that his contribution to historical study is not merely of value but is essential. The method of production of the book deserves a word of praise: the clear black type, good paper, many line drawings (in place of photographs), maps, plans and admirable coloured plates—all add to the charm and dignity of the volume. Only an index is missing. R. N. R. B.

ÖSTERSJÖHAMNARNAS GEOGRAFI. Särtryck ur Östersjöhamnarna före och efter världskriget. By STEN DE GEER. *Stockholm: Svenska Hamnförbundet* 1927. 9×7 *inches;* 57 *pages and* 4 *sketch-maps*

At one time Sweden held, for a moment, all the eastern and north-western shores of the Baltic Sea; now no fewer than nine nations have ports upon it. It is indeed once more the Mediterranean of the Teutonic races, with a history as romantic as it is little known. Reckoning in the Kattegat as the mouth

of the Baltic, Baron de Geer has written a study of ninety-two Baltic ports, analysing the geographical and industrial factors which make for the success or failure of a harbour and making detailed tables of comparison. The book is so packed with figures, facts and interesting observations that it is impossible here to do more than summarize the author's main conclusions.

Baron de Geer's grading of his ports is based on the amount of shipping (reckoned in net Swedish tons) entering and leaving the ports, with special reference to the increase or decrease between 1913–14 and 1923–24. The shipping figures quoted include craft of every kind, and would therefore include vessels belonging to the port making short trips. The three greatest harbours are Hamburg (increased from 35 to 39 million tons, 1914–24), Copenhagen (increased from 10 to 11 million), and Göteborg (from $5\frac{1}{2}$ to 7 million); while after these come, in order, Stockholm, Danzig, Stettin, Helsingfors, Viborg, Riga, Katka, Reval and St. Petersburg. Although, as the author says, Hamburg is closely connected with Lübeck and Kiel, we cannot agree with him in calling Hamburg a Baltic port and counting all its shipping as Baltic, especially as Lübeck and Kiel are given their own tonnage. Hamburg is a North Sea port.

This grading gives Finland three of the greatest ports, Sweden two, and Denmark, Germany, Latvia, Lithuania, Estonia, Russia and Poland (Danzig) one each. Of the 92 ports tabulated, 44 are Swedish, with $49\frac{1}{4}$ million tons of shipping; 18 Finnish, with $13\frac{1}{4}$ million; 14 German (excluding Hamburg), with $16\frac{1}{2}$ million; 7 Danish, with $23\frac{1}{2}$ million; and 8 belong to the other countries, with nearly 10 million tons. The greatest harbours are ocean harbours, five of the greatest are the ports of capitals, and seven capitals have important harbours; this, the author believes, is a rule.

There has been, in general, a decrease in Baltic traffic during the years 1913–24. But there has been increase in three regions: (1) The Kattegat and South Scandinavia; (2) South Finland; (3) Danzig and the neighbouring coast. Among others, Riga and St. Petersburg have decreased, as well as all the North German ports. Aalborg, Aarhus and Odense in Denmark have increased, but all the East Swedish harbours except Norrköping and Stockholm have decreased, possibly owing to the reduced demand for wood and iron since the War, while the South Scandinavian ports are prosperous because they serve the most important agricultural regions of the North. The national boundaries set up since the War have affected some ports seriously: *e.g.* Viborg has gained at the expense of St. Petersburg, and Memel and Danzig at the expense of Libau and Königsberg, while Flensborg has lost profitable trade with North Schleswig. On the other hand, Danzig now serves Poland, and has flourished accordingly. The great development in the Kattegat is partly due to the establishment of Swedish and Danish ocean-going lines. The decline of the Pomeranian ports is the result in part of the post-war economic depression in Germany and in part of the concentration of traffic at Hamburg.

The author has an interesting chapter on the *bakland* or district served by and serving a harbour. Ports on bays and river mouths (*e.g.* Riga, Viborg) generally have a *bakland* which spreads out like a fan as it goes inland, while harbours on promontories (*e.g.* Karlscrona, Reval) serve a decreasing or V-shaped region. This is not always true. Cape harbours are best for naval purposes and are also much used by mail and passenger ships, while bay-harbours are more useful for heavy goods traffic.

Baron de Geer has made a close examination of such factors as depth of water at the quay, length of accessible quay, area of storage on quay, and

number of cranes, fixed or movable. He finds that ships drawing 10 metres, though they will come up to Copenhagen, will not venture through the Sound. The Danes are now deepening the Sound at Drogden. Norrköping and Aalborg have too little depth at the quay. Göteborg, Aalborg, Helsingfors and Viborg have all got quays insufficient for their trade, but Riga and St. Petersburg now have more than they need.

Baron de Geer's book is not only a fascinating study in economic geography, but a useful introduction to little-known waters. It is the best work on the subject which has yet appeared, and an English translation is very desirable. E. L.

DENMARK. A MODERN GUIDE TO THE LAND AND ITS PEOPLE. By CLIVE HOLLAND. *London: Simpkin Marshall* [1927]. 7×4 *inches;* xii+179 *pages,* 33 *photographs and a sketch-map.* 3*s* 6*d*

The title of this book describes it fairly exactly. Most of the usual particulars about fares, hotels, tariffs, distances and excursions are omitted, and Mr. Clive Holland has given his information about places and people in a form which is unsystematic but none the less effective. He has adequate knowledge and an excellent descriptive style; only in the historical references is there any lack of clearness.

Mr. Holland tours Denmark island-wise, taking Sjælland, Bornholm, Fyen and Jutland in turn, but omitting, of necessity, the smaller islands. Like many Danes, he seems inclined to regard Copenhagen as more important than the rest of Denmark, and has devoted much space to that hospitable city and to its museums and artistic treasures. Descriptions of art collections are, however, preferable in the form of catalogues, which can be put aside for a rainy day; while the outlying parts of Denmark are not as well known as they should be. More might have been said, for example, about the characteristics and history of the people of Jutland and North Schleswig. Indeed, as regards the Danish people, the author has not quite fulfilled the promise of his title, though he has written a pleasant account of the manners and customs, favourite dishes, amusements and sports of the Copenhageners. The descriptions of scenery are generally very well done.

The book is a very capable introduction to Denmark—better, in many respects, than more pretentious works. For a guide-book so well written, illustrated, and printed the price is remarkably low. E. L.

SILHOUETTES OF REPUBLICAN GREECE. By BETTY CUNLIFFE-OWEN. *Hutchinson & Co. Ltd.* 1927. 9×6 *inches;* 278 *pages; illustrations and sketch-map.* 18*s*

Though this volume has a crude but useful sketch-map and forty beautiful photographical illustrations, the author herself would be the last to claim that her "Silhouettes" came within the class of geographical books. Indeed, it is just because Mrs. Cunliffe-Owen makes no unfounded claims but shows herself none the less a keen observer that her latest work is so charming, colourful, and attractive.

The wife of Col. Cunliffe-Owen, who was engaged in the work of the Refugee Settlement Commission, she spent various periods between 1924 and 1926 in Athens and the neighbourhood. She heard and saw a great deal of the exchange of Græco-Turkish populations, she took part in many social events, and she toured Greece and got to know the Greeks, who she correctly says are prone to favour the cafés, to smoke and to discuss politics, and who are an exceptionally intelligent and versatile people.

The authoress is a sympathetic person who has an eye to all that passes round her. Boatmen and guides tell her the tragedies of their lives, she notices that the Kaiser used to sit astride a saddle at the writing-table in his Corfu villa, and she tells us that no piers are ever built in Greece because this would deprive the boatmen of their opportunities, and they would not permit it. She was practically forced to take a guide in Corfu, when she hated the idea but subsequently liked the individual, and she was present at the evening party at which her host, M. Papanastasiou, the ex-Prime Minister, was made a political prisoner by General Pangalos. In short, if Mrs. Cunliffe-Owen adds nothing to the stock of geographical knowledge, her book will provide many readers with a few hours of entertainment and instruction.

H. C. W.

GEOLOGY OF MONGOLIA: A Reconnaissance Report based on the Investigations of the Years 1922–1923. By Prof. CHARLES P. BERKEY and FREDERICK K. MORRIS. Central Asiatic Expeditions; Natural History of Central Asia, Vol. 2. *New York: American Museum of Natural History; London: G. P. Putnam's Sons Ltd.* 1927. 11×9 *inches;* xxxi +475 *pages;* 44 *plates and* 6 *maps.* $10

The expeditions to Central Mongolia organized by Professor Roy Andrews discovered some fossils of sensational interest. The fossils are of great importance from their biological relations, and also geographically as proof of a former easy connection by land across the North Pacific between the United States and China. The first issued of the technical volumes on the work of the expedition contains the detailed account, by Professor Berkey and Mr. F. K. Morris of the American Museum of Natural History, of the Geology of Mongolia. It is mostly occupied by the report of their field observations, and is illustrated by elaborate sections along the routes traversed. These statements of facts are accompanied by an interesting discussion of the general results both as regards geology and physical geography.

The whole work is entitled 'The Natural History of Central Asia,' whereas the expedition's field of work would be more precisely described as East Central or Central Mongolia; the latter name is frequently used in the text to designate the area, as, for example, in the maps on pp. 204, 304. The term Central Asia as used in the text is ambiguous, as it is sometimes doubtful whether by it is meant the area investigated by the expedition or what would be generally understood by Central Asia. The expedition travelled through Peking to Kalgan, and thence traversed the arid plains of Central Mongolia to Urga, and especially investigated the region to the south-west of that town. The geological result of most importance, after the discovery of the fossils, is the determination that that part of Mongolia is underlain by a platform of pre-Palæozoic rocks which stood above sea-level throughout the Lower and Middle Palæozoic; hence this region has no representatives of the older fossiliferous rocks which are widespread in Central and South-Western China. The country was submerged in the Carboniferous and Permian periods, and then again upraised and has been above sea-level ever since. The post-Permian formations are all of a continental type, and of the kinds that accumulate in basins within the heart of a continent.

The geological problems discussed in the volume are of great interest; they deal with the formation of the basins in which the remarkable fossils discovered by the expedition were buried, with the levelling of the country into plains, and with the moulding of the land in the interior of a great continent. The authors attach comparatively little importance to wind in planing down rocks.

They recognize its great power of transporting loose material, but consider that it accomplishes little direct abrasion of compact rocks. They attribute the crumbling of rock in such countries to its decay by weathering and its destruction by running water. They show that the dominant feature in the topography of Mongolia is a series of great peneplanes—the spelling adopted in the work—and that they are of distinct ages; but they differ from the conclusions that have been adopted for the plains of the Sudan and parts of Australia. They attribute the peneplanes to streams of water during times of flood and not to the levelling action of the wind. An interesting chapter summarizes the evidence for the climatic variations in Eastern Mongolia. The oldest precise information is in reference to the Permian, in which the authors remark that the absence of reef corals indicates that the sea then had the temperature of the temperate zone. Subsequently the continental deposits accumulated in the Gobis, which, according to the use of that term by the authors, are basins with a desert floor. These basins are attributed to wind action which uplifted and removed the loose material. The evidence of these successive deposits showed that the predominant climate throughout the long period from the Permian to the Pleistocene has been moderately arid. The most marked climatic change was during the glaciation of some parts of the world, when Mongolia enjoyed an ampler rainfall and more humid conditions. The authors support the view of Professor Ellsworth Huntington that climatic changes have been sufficient to have been one of the great causes of human migrations; but apart from the disturbance of the glacial period, the evidence available from Mongolia and Eastern China, represent the country as having had much the same climate as at present throughout historic times. The authors show that there has been but little volcanic activity in the region, and the only trace of glacial action they describe as negligible or as an incipient glaciation during the formation of some cirques, which are due to frost action and frequent sharp changes of temperature. The authors call attention to the great importance of folding and earth-movements on the topography, and in their classification of the mountain system of Asia lay special importance on the constancy of the influences which have acted upon it throughout the whole of geological time.

The volume is most generously illustrated with beautiful coloured plates, excellent photographs and geological maps, and many clear and instructive diagrams. It forms an addition of primary importance to the geology of Asia and is of geographical importance from its study of the tectonics of Asia, and of the processes which mould the interior of an arid land, under conditions obviously different from those of Africa and Inner Australia. J. W. G.

TRANSKAUKASIEN, eine technische Geographie. Von A. BUDEL. (Ergänzungsheft Nr. 189 zu *Petermanns Mitteilungen.*) *Gotha: Justus Perthes* 1926. 11×8 *inches;* vi+152 *pages; illustrations and maps. M.*22

As the bibliography of 212 items shows, much of the information on Transcaucasia is to be found in publications in Russian, and this account in the German language is useful in rendering accessible a considerable amount of information not otherwise readily available.

Rather more than half the space is devoted to a systematic description of the physical geography of the region under the divisions Orography, Cartography, Geology, Climate and Hydrography; political and economic aspects are considered more briefly. The account given compresses much information in a small space and the systematic arrangement makes reference easy. The authorities quoted, other than Russian, are nearly all German; only two items

in English are listed in the bibliography, one dating from 1887. Thus under geology and petroleum even such a well-known work of reference as Beeby Thompson's ' Geology of the Oilfields of Russia ' finds no mention. L. D. S.

CEYLON, PAST AND PRESENT. By Major C. M. ENRIQUEZ. *London: Hurst & Blackett Ltd.* 1927. 9×6 *inches;* xvi+256 *pages; illustrations and sketch-maps.* 21*s*

In view of the recent fine work of the Archæological Department of Ceylon there was room for another book to supplement the labours of Cave, Forbes, Tennant and Mitton (the three former freely quoted in the work under review). The modern writer, however, who goes over well-known ground, needs to be particularly well steeped in the history, philosophy and religion of the land he sets out to describe. Major Enriquez appears to have felt all the fascination of the Spicy Isle and its story, but somehow he does not quite succeed in imparting it to the reader. The book is far too much a series of disconnected notes, with irritating repetitions, to achieve its proper purpose of interesting the uninitiated. Such as it is it tries to give far too favourable an impression of that early civilization described to us in the blood-stained pages of the Mahavamsa. The full story of Dhatu Sen and his parricide son would have borne repeating. We might at least have been reminded that the disasters falling upon the former were held to be the just retribution of his awful crime in burying alive a recluse when building the dam of the Kalawewa. The descriptions of Polonnaruwa contain most of the new matter.

Major Enriquez is better in the " Present." His descriptions of scenery have a true poetic touch, and there is a spirited account of an ascent of Adam's Peak. He was apparently not fortunate enough to witness the ritual at the Temple of the Tooth at Kandy. (The photograph, by the way, might be misleading to the uninformed reader. It does not show the actual temple, but the octagonal library.)

Apart from useful appendices, the book concludes with two chapters of commentary. One is a not very gracious condemnation of the workings of " democracy " in Ceylon. The democratic experiment is going to be made: its problems must be approached with sympathy and understanding. It is merely tiresome to be told that " the native only wants to be let alone." The other chapter is a brief panegyric on Buddhism—the philosophy that has so largely made the people what they are. Major Enriquez has clearly not grasped the problems raised by early Buddhism, or he would have shown a better appreciation of the position of the Mahayanists, but he asks us to try and recapture the original pure message of the Teacher. Perhaps some have done so—and found it wanting, in spite of all its grandeur. To escape from sorrow may not be the whole end of existence. A greater religion has taught, amongst other higher things, that Sorrow is Divine.

The map is poor and there are no plans. Better proof-reading would have avoided mistakes and inconsistencies in spelling. A. S. E.-S.

CHINA; Wirtschaftspolitische Landeskunde. By F. OTTE. (Ergänzungsheft Nr. 194 zu *Petermanns Mitteilungen.*) *Gotha: Justus Perthes* 1927. 11×7 *inches;* xii+112 *pages; diagrams and map. M.*16

Dr. Frederich Otte was, until recently, a professor at the National University of Peking, having previously been connected with the Maritime Customs Inspectorate in China, and is thus well qualified to write an account of Chinese affairs. At the present time, when details of Chinese production and trade are more than usually difficult to obtain, it is useful to have this brief summary of

what is known, together with statistics up to and including 1926. The three sections deal with Government, Production and Trade, and the table of contents further indicate the wide field covered. Where a regional treatment is required the broad division into Manchuria, North, Central and South China is adopted.

L. D. S.

TRAVELS OF FRAY SEBASTIEN MANRIQUE, 1629–1643. A translation of the *Itinerario de Las Missiones Orientales:* with Introduction and Notes by Lieut.-Col. C. ECKFORD LUARD, assisted by Father H. HOSTEN, S.J. In two volumes. Vol. I. Arakan. (Works issued by the Hakluyt Society. 2nd Series, No. LIX.) *Oxford: University Press* 1927. 10×6 *inches;* lxvi+450 *pages; illustration and sketch-maps.* 27*s* 6*d*

These travels would in any case be important from their date and extent, and are best divided into four journeys, starting in the first instance from Cochin, on the west coast of India: (1) Arakan, (2) China and the Far East, (3) across India, (4) Rome overland *viâ* Afghanistan and Persia. The first volume comprises one of the most valuable journeys of all, covering a period of ten years, as so little comparatively is even now known of much of the country concerned, and the editing of Manrique's remarks must have proved a most formidable task. It may be said at once that judging by the reviewer's own considerable experience of such work in much the same regions as those in which Manrique travelled, the editing is admirably performed, though this remark hardly applies to the maps, which require in fact a good deal of revision before they can be accepted. The notes of Manrique's statements as to currency and on some of the vernacular terms used by him might also have been carried further with benefit to the reader in some instances, but this is quite a minor point. On the other hand, Manrique, as an Augustinian friar, freely interlarded his account with allusions to books and matters connected with his faith, and these have been explained in many an illuminating note.

In judging Manrique's work it is necessary to observe that he travelled, as above said, as an Augustinian friar on missionary expeditions—indeed, his book is entitled 'Itinerario de las Missiones Orientales'—and he wrote for a public of ecclesiastics, whose ideas he had to keep before him and did in fact himself share. He was moreover no practised writer, composing his account in a bald Spanish style, and he possessed in addition the defects of his time. He plagiarized without restraint, borrowed wherever he could to enhance the value of his book, told tall stories without a blush, and filled his pages with his prejudices and with remarks that played up to his audience; finally he was fond of fine writing, which at times tries the patience of the modern reader. His editor shows that he borrowed largely from de Laet and Pinto, and this leads the reviewer to express a very great regret for Colonel Luard's untimely death, as he had undertaken to edit Pinto also, and this traveller badly wants such editing as Colonel Luard could have given. There is much reason to believe that Pinto was by no means the unmitigated liar he was so long held to be, though no doubt he exaggerated and misunderstood much that he heard.

The above remarks should not, however, be held to detract from the value of Manrique's astonishing journeys. Where he tells us of what he actually saw he is an invaluable witness for any one engaged in geographical or historical research, if the inquirer discounts the prejudices with which his stories are invariably permeated, and so far as his Arakan journey is concerned it must be remembered that he is taking us to a part of the world of which he is almost a solitary eye-witness.

Once more, in perusing Manrique's pages, one is filled with admiration for

the pluck exhibited by the pioneer travellers and for their endurance of hardships. Leaving aside all exaggerations that may have crept into the narrative, to journey, as Manrique did, through the hilly jungles of Arakan in full monsoon is a task severe enough to appal even those who go fully equipped, and Manrique had practically no equipment. Again, to take another instance, the account of his treatment by the Kotwal of Midnapur, in Bengal, and Moboto Kan (Muhabbat Khan), the surgeon, for the cure of the wounds inflicted at the orders of the Kotwal, testifies to a wonderful endurance, and one has no call to quarrel with its general accuracy.

Although it is necessary to exercise discretion in accepting Manrique's statements, we may agree with Colonel Luard as to the need of care before rejecting his accounts of Arakanese festivals, ceremonies, and the like, merely because they are not in accord with the orthodox forms of the professed faith of the country—Buddhism. It cannot be too clearly impressed on observers that Buddhism in daily practice at the present day and in Manrique's time in the seventeenth century is as far removed from the precepts laid down in the Buddhist scriptures as are the customs of modern Christianity from the laws prescribed in the Pentateuch.

In this rapid survey no attempt has been made to describe Manrique's wonderful journeys in detail. Suffice it to say that Colonel Luard's book is worthy of the Hakluyt Society, which has laid searchers under a great obligation by publishing it. R. C. T.

L'ISLAMISATION DE L'AFRIQUE DU NORD: Les Siècles Obscurs du Maghreb. Par E. F. GAUTIER. *Paris: Payot* 1927. 9×6 *inches; 432 pages; maps and illustrations. Francs* 30

The works of M. Gautier are sufficiently well known in this country for any new volume from his pen to attract attention. His latest contribution to the history of North Africa is a study of the Maghreb during that obscure period which lay between the two Arab invasions, the conquest of the end of the seventh century and the Beduin infiltration which began in the middle of the eleventh. "C'est la grande époque," writes M. Gautier. "C'est le moment où le Maghreb conquiert l'Espagne, la Sicile, l'Egypte."

The first half of the book is devoted to introductory matter covering the geography of the country—its insular character, surrounded by sea and sand, being insisted upon—the Arab historians, the Carthaginian and Roman occupations, and racial movements. The chapter on the fauna of the Roman period and its distribution, affording curious instances of survival, will be widely appreciated. M. Gautier emphasizes the social and economic effects of the introduction of the camel from Asia by the Romans.

The author's arresting description of the first Arab invasion and his study of the turbulent and complicated history of the succeeding centuries are principally valuable for their suggestiveness. The historical student will quickly discern original lines of thought which he may do well to pursue. The more we read of the history of North Africa, swept time and again by invaders—Carthaginians, Romans, Vandals, Byzantines, Arabs, Turks and French—the more remarkable becomes the virility and persistence of the Berber stock. It was perhaps during the Arab period that submersion seemed most probable, but the completeness of the Berber survival is insisted upon by M. Gautier.

The turbulence which followed the first successful invasion was principally due to the fury which the nomads directed against the rule of the Caliph and which found expression in the Kharedjite heresy. But in time even this gave

place to tranquillity; and Fez, the refuge of the sedentary from the ferocity of the nomad, emerged as a separate kingdom.

The seizure of Kairwan by the Fatimid Caliph provoked another upheaval. The Fatimids were succeeded by the Sanhadja, whose rule was at one time established over nearly all the Maghreb. But their dominion, in turn, crumbled before the second Arab invasion which was launched from the East in the middle of the eleventh century.

The last few chapters are based upon the work of Ibn Khaldun, of whom the author is keenly appreciative. The extraordinary breadth of vision of the great Arab historian and his detached outlook upon the world seem to belong to modern Western civilization. The book contains a great store of original matter and merits careful study. The excellent bibliography is particularly welcome.

E. W. B.

TO THE MYSTERIOUS LORIAN SWAMP. By Capt. C. WIGHTWICK HAYWOOD. *London: Seeley, Service & Co. Ltd.* 1927. 9×6 *inches; 272 pages; illustrations and sketch-map.* 21*s*

This volume is a reminder that there are still parts of Kenya Colony where British rule is only nominal, where communication is difficult, and where the tribesmen are fearless, warlike, and none too amenable to our interference with their time-honoured raiding proclivities. The Lorian Swamp lies about 200 miles W.N.W. of Kismayu. It fills part of the river-bed depression between the rivers Juba and Tana and receives the waters of the Uaso Nyiro, which higher in its course flows through the Laikipia plateau, where there are Europeans engaged in stock rearing. The principal object of Capt. Haywood's pioneer journey (which was undertaken in 1912 and briefly described in the *Journal* for May 1913) was to open a trade route from Kismayu through Jubaland, by Wajheir to the Lorian Swamp, and on to the Meru country at the foot of Mount Kenya, thus affording the Somali tribes an opportunity for peaceful and profitable inter-tribal trade and for supplying domestic livestock to the Laikipia settlers. This object was accomplished.

The journey was not long, measured in actual miles, but the greater part of the route to the swamp ran through waterless desert and thorny scrub country. In addition to the ordinary risks attendant upon travelling any distance through such a region, there was the constant menace of notoriously treacherous tribes encamped near the various water-holes. On one occasion the caravan nearly perished from thirst, and on another only the firmness of its leader saved it from annihilation by the Somali. The rest of the journey beyond the swamp lay through fairly pleasant country inhabited by friendly tribes, of both of which an entertaining account is given. Capt. Haywood also writes engagingly of the coastal region between Kismayu and Lamu, and interspersed throughout the volume there are valuable comments on the life and customs of the various tribes, and the flora and fauna of this little-known territory. The book is well illustrated by photographs and contains an excellent map of the country through which the journey was undertaken.

A. G. C.

PLACE-NAMES IN THE CAPE PROVINCE. By COLIN GRAHAM BOTHA. *Cape Town and Johannesburg: Juta & Co. Ltd.* [1927]. 7×5 *inches;* 186 *pages; map.* 5*s*

The origin of place-names very soon becomes wrapped in obscurity. A settlement is called Alice; but it appears that in less than a century from its foundation the identity of the lady after whom it was named is in dispute. It is, therefore, highly satisfactory to find the Dominions beginning to record

the origins of their names before they are forgotten. The Geographic Board of Canada issued with its 17th Report in 1922 a section on the meaning of Canadian city-names. And now the Chief Archivist for the Union has given us this admirable study of place-names in the Cape Province, to which he has evidently devoted much patient research.

Several peoples have contributed to the nomenclature of southernmost Africa. Portuguese navigators named coastal features only, such as Cape Agulhas, said to be so called from the magnetic needle being found here to point due north. Inland, the first natives to arrive were the Bushmen, driven south by the Hottentots, who were in their turn pushed on by Bantus. All have left their mark on the place-names. The author, however, does not profess to have investigated names of native origin; but he tells us a few interesting facts, as that Hottentot terminations are found in -qua (Outeniqua, Namaqua, Griqua) =men of, -touw or -douw (properly -daob)=mountain pass, -kama or -kamma (properly -gami)=water, while Karoo is from the Hottentot kuru=dry.

With the arrival of the Dutch in 1652, the native names were written down in Dutch guise, and the map began to be covered with names of Dutch farms. The migrations of the farmers in the eighteenth century are illustrated by a sketch-map, and the routes of early explorers are described. Many of these farms have names of large wild animals now exterminated in this region, as Oliphants Kop and Rhenosterfontein. Others are named after smaller animals, birds, fishes, and also the flora, some varieties of which are now extinct in the locality. There are naturally many personal names, the most ingenious being Libertas, named by a certain Adam Tas after his liberation from prison in 1706. The Dutch East India Company is commemorated in names beginning Compagnies —, while names beginning Moordenaars — (=murderers) probably refer to atrocities committed by roving Bushmen. Settlements were not often given European place-names except by French refugees in 1688. While noting that words like eiland and baai have been translated into English though the distinctive name has often remained Dutch, as Robben (=seal) Island and Mossel (=mussel) Bay, the author points out that Afrikanderisms often cannot be rendered by English etymological equivalents: *e.g.* nek=col, not neck; hoek=nook, not hook; klip=boulder, not cliff; poort=pass, not port. He seems to have overlooked the possibility of rendering duinen by dunes, objecting to "downs" as referring to "undulating plains along the coast." Kraal is said to be derived from Spanish corral and Portuguese curral=cattle-pen, and to have been the name given by the early Dutch settlers to Hottentot villages, though it is not clear why they should have borrowed a Spanish or Portuguese term.

After the final occupation by the English in 1806 places were named after English royalty, statesmen, Cape Governors and officials, and even after their relatives (notably fathers-in-law); and we get a whole host of names like Caledon, Cradock, Clanwilliam, Beaufort, and Worcester. Port Elizabeth was called after the deceased wife of the acting Governor, Sir R. Donkin, in 1820. Ladismith, originally spelt Lady Smith but altered later to distinguish it from Ladysmith in Natal, is, like that place, called after the wife of Sir Harry Smith, Governor in 1847; while his victory over the Sikhs in India is commemorated in the names Aliwal North and South. In the Eastern Province are places like Grahamstown, named after soldiers who fought in the Kaffir Wars; and along the coast we naturally find names of sailors and their ships. German names near East London were given by settlers from the German Legion that came out after the Crimean War. Finally, the Missionaries are

responsible for bestowing not only Biblical appellations but also names of their Societies' officials. Kamastone is a curious portmanteau word commemorating both the Christian Chief Kama and the missionary Shepstone. But we have quoted enough from this fascinating record. J. H. R.

IMMIGRANT BACKGROUNDS. Edited by HENRY PRATT FAIRCHILD. *New York: John Wiley & Sons; London: Chapman & Hall* 1927. 8×6 *inches;* x+269 *pages.* 13*s* 6*d*

This is a composite volume, the contributors to which are specialists familiar with the immigrant groups with which they deal. The editor contributes an introductory chapter answering the question: What is an Immigrant Background? as well as the chapter on the Greeks. The answer given to the question put in the first chapter is that the background of the immigrant is the environment which he has left behind in its entirety. He experiences a complete change in this environment both human and physical when he enters a new country. What constitutes the background is much more a matter of nationality than of race (p. 5). "Men are fundamentally much more alike than they are different" (p. 8). The groups treated of in the different essays are not confined to those whose immigration is permitted under the Act of 1924. One of the most interesting illustrations of the importance of the consideration of the background from the American point of view is presented in a report quoted from an official of the San Diego county, California, as to the success of Japanese farmers coming from a country where they are used to cooperative organization, as compared with white farmers, during a period of severe droughts lasting from 1912 to 1915. At the close of the second dry season fully half of the white farmers had moved away. The Japanese, suffering as much as the whites, worked all the harder and remained, and they still stayed on after the third dry year when very few American farmers were left. The Japanese helped each other with loans and in other ways. "They weathered that drought not because they were better farmers than the White men, but because they pulled together" (pp. 189–90). This illustration may at the same time serve to indicate the general purport of all the essays, from nearly every one of which something significant can be gleaned as to the way in which the background has fitted the immigrants to adapt themselves more or less speedily to the new environment or has offered hindrance to their doing so. Compare, for example, what is said as to the rapid Americanization of the Jews (p. 183) and the difficulty which the Italian immigrants, coming as they do mainly from the southern and more backward part of the country, find in adapting themselves fully to American ideals (p. 113). G. G. C.

THE DISCOVERY AND CONQUEST OF MEXICO, 1517–1521. By BERNAL DIAZ DEL CASTILLO. Edited by GENARO GARCIA; translated by A. P. MAUDSLAY. (The Broadway Travellers.) *London: George Routledge & Sons* 1928. 9×6 *inches;* 596 *pages, and illustrations.* 15*s*

This volume is a useful condensation of the translation of Bernal Diaz' famous book, made by Dr. Maudslay a few years ago and published in four volumes (with a volume of maps) by the Hakluyt Society. The 'True History of the Conquest of New Spain,' it will be remembered, was written at the end of the sixteenth century by one of the captains of Cortes, and the MS. of this vivid narrative was only recently recovered and published, in its original Spanish form, by the late Dr. Garcia, of Mexico. Dr. Maudslay's excellent translation introduced a genuine human document to English readers, and in the present handy form the story will reach still more. The notes and appendices of the

Hakluyt publication are omitted, also the facsimiles of charts and plans; the voluminous index has been reduced, and that part of Bernal Diaz' story dealing with the march into Honduras is not included. There remains the lively story of the conquest of Mexico by the soldiers of Cortes, a perennial romance told by an eye-witness, the man of the camp, simple, observant. Were that bluff old soldier alive to-day he could want no better version of his narrative than this, for Dr. Maudslay's rendering is eminently successful: no feeling is roused that the reader is perusing a translation. The volume is competently produced and printed, the 15 illustrations are well chosen, and the index is adequate.

L. E. E.

MEXICO, LAND, VOLK UND WIRTSCHAFT. By KARL SAPPER. *Vienna: L. W. Seidel und Sohn* 1928. 9×6 *inches;* 164 *pages; illustrations and map. M.*8

The writing of a satisfactory geographical account of Mexico is a difficult enough task even for those such as the author of this book who have travelled on several occasions in the country. The area is a large one and is very diverse, communications are poor, official statistics and other public information services are wretched, and travellers have apparently found fewer opportunities of collecting reliable scientific material than in most other settled parts of the world.

Karl Sapper's book, a new edition of his 'Wirtschaftsgeographie von Mexico,' bears evidences of these disabilities, and suffers also from the fact that too much is attempted. The physical and climatic features and the detailed economic geography of a large country cannot well be treated within the compass of some 130 pages, unless one has a much greater gift of selection than the author shows. The result is a laboured performance which takes us through each of the seventeen sections into which the work is divided, with a conscientious but somewhat uninspired energy. Imagination may be a rare gift, but it is often indispensable in geographical writing.

The economic map (the only one supplied) is difficult to read, and is distinctly misleading in the space allotted to wheat, of which we learn from Table XI that the whole country produced only a little over a million quarters in 1924. On the other hand, it is only fair to add that every care appears to have been given to making the great array of facts in the text as accurate and up to date as possible, and that the work accordingly constitutes a very useful source-book of information, especially for the business world. E. W. S.

"THE TIMES" BOOK ON ARGENTINA. *London: "The Times" Publishing Co. Ltd.* 1927. 10×6 *inches;* 332 *pages; illustrations and map.* 17*s* 6*d*

A glance at the table of contents of this number shows that all the leading aspects of the economic and social life of Argentina come under review; while on reading through the individual sections we find that each gives us very complete and up-to-date information concerning the topic it deals with. Among these perhaps the most informative are those on Transport and Communications, to which more than eighty pages are devoted, and on Finance, which contains much material not generally accessible. Two other sections that are deserving of mention, in that they are very serviceably done, are those dealing with Agriculture and National Industries.

A strong feature of this work is the statistical material it supplies. An immense amount of attention has evidently been given to collecting an imposing array of figures which appear mainly in the form of comparative tables, but which are also used freely in the body of the text to give numerical precision

to the statements made. Generally speaking, the figures are complete to the close of the year 1926. The book is compiled chiefly for use by those having business dealings with or in Argentina, and is an excellent example of the topical encyclopedic sort, in which information required by every possible commercial interest is supplied and made immediately obtainable through an unusually complete index. Incidentally, also, the book will not be without considerable value as an authoritative and up-to-date source-book for University teachers and others who are interested in one way or another in the vigorously expanding life of the Republic. E. W. S.

TERRITORY OF NEW GUINEA, ANTHROPOLOGICAL REPORTS, Nos. 1 and 2. By E. W. PEARSON CHINNERY. *Melbourne: H. J. Green* (n.d. ?1927). 9×6 *inches;* 238 *pages, and illustrations*

The Government of the Territory of New Guinea, by which is meant the mandated area, formerly German New Guinea, has now issued its first anthropological reports, the firstfruits of some years' work by Mr. Pearson Chinnery, the Government Anthropologist. The volume consists of two parts: a series of notes on the inhabitants of different districts of the mandated territory visited during a three-months' cruise in the Government steam yacht during 1925, and an incomplete but valuable account of the hitherto little-known natives of E Mira and St. Matthias Islands, lying under the Equator some 2 degrees east and slightly to the north of the Admiralty Islands.

The material presented in the first portion, though useful and covering a wide area, is necessarily fragmentary. Mr. Chinnery could spend but little time at each site, and every one who has done field work knows how difficult it is to hold the attention of natives as one of a number of visiting strangers. The existence of the blow-gun and dart (unpoisoned) is noted among a number of tribes inland from Moewehafen in New Britain, and it is said that with these birds are killed in the tops of the highest trees. There is also useful information adding to our knowledge of the Mortlock and Tasman groups—small atolls inhabited by a people speaking Polynesian, and whose appearance suggests strong Polynesian affinities, or, perhaps more accurately, a large infusion of Polynesian blood.

The second part of the Report, dealing with E Mira and St. Matthias, is particularly interesting from the point of view of decorative art. Mr. Chinnery only touches on this subject, but it is obvious that these islanders have a well-developed highly conventionalized form of geometric art, the various patterns of which are called by the names of natural objects to which for the most part they have little or only the slightest resemblance. At the same time the ends of house beams are carved into more or less naturalistic representations of fishes, etc.

To sum up, this volume will be of the greatest use to those concerned with the ethnology of the Pacific, and it is to be hoped that it is only the precursor of larger and more important works. In this expectation it may be suggested that many of the photographs suffer from being reproduced on too small a scale, while the use of a rather finer screen in their production would greatly enhance their appearance. C. G. S.

THE KIWAI PAPUANS OF BRITISH NEW GUINEA. By GUNNAR LANDTMAN, with an introduction by A. C. HADDON. *London: Macmillan & Co.* 1927. 9×6 *inches;* xxxix+485 *pages; illustrations and sketch-map.* 30*s*

Dr. Landtman is to be congratulated on the publication of his important volume—the first monograph to appear on any of the true Papuan tribes of

that territory which, in spite of its official designation, Papua (equally the name of the whole great island) may still, as on the title-page of this book, be called with less ambiguity British New Guinea. For two years, including two rainy seasons, the author lived among the natives of the Fly River estuary, a feat which for fortitude in facing discomfort is probably the most exacting test to which any field anthropologist has yet submitted, for the mouth of the Fly is a vast alluvium, at most a few feet above the river; rock is absent except for an outcrop at Mabudavane opposite Saibai, and in the wet season the district is for the most part mud rather than earth or water. At this time everything becomes sodden and mosquitoes swarm, while throughout the year—in spite of fish, and some turtle and dugong in their seasons—it is necessary to live largely on tinned food. Dr. Landtman has then fairly earned the repute which this book, with his previous work on the Folklore of these Islanders, will surely bring him.

The Kiwai are a people who build huge communal long-houses, have a rich ceremonial life, and of old carried on a considerable trade in their district and with Torres Straits, yet they have but two numerals, "one" and "two," which are combined up to "five"; above this fingers are used, and supplemented for special purposes by tallies. With such undeveloped numerical sense it is interesting to observe how little inferior is their cosmogony to that of much more advanced peoples. Heaven (*áromo*) is explained as a blue solid vault, although uncertainty prevails as to its composition: as it cannot be wood or earth, it is generally thought to be of stone and is regarded as a stationary cupola, along which the heavenly bodies move, "walk about all same crab." The country of the white men is where the *áromo* reaches the ground, and there they break off pieces of it, and this is iron. The ruddy glow at sunrise and sunset forms a covering over the *áromo*; this also is appropriated by the white men, who obtain their calico—mainly, be it remembered, "Turkey Red"—from it. Nor is there anything particularly simple about their eschatological beliefs.

There are no differences of rank; not only is every man on a footing with his fellows, but there is a conscious egalitarianism, "no want one man he go ahead, one man he come behind; better all man he go together," said one of Dr. Landtman's informants, thus in "pidgin" English definitely expressing the desire and condition of social equality. Even in warfare there seem to have been no chosen chiefs, though it is clear that noted warriors exerted considerable influence amounting at times to authority. The people are in fact ruled, *i.e.* led, by the old men, who generally seem remarkably of one mind. The conviction that age brings with it wisdom and experience seems to have produced an almost ideal gerontocracy; perhaps it was this aspect that led the author to equate his subjects with "Rousseau's ideal community." If so their supremely unattractive processes of magic effectively differentiates them from the hypothetical noble savage of the eighteenth century.

Space is lacking to enter more fully into the many interesting facts chronicled in this, one of the noteworthy books of the year. But since it will long remain a standard work of reference and comparison to all concerned with "primitive" man, it is fitting to express the indebtedness which all investigators in this difficult field will feel to the Government of Papua for rendering possible the publication in English of this important volume. C. G. S.

THE LIFE OF GEORGE NATHANIEL, MARQUESS CURZON OF KEDLESTON. By THE EARL OF RONALDSHAY. Volume I. *London: Ernest Benn, Ltd.* 1928. 10×6 *inches;* 318 *pages, and illustrations.* 21*s*

In this first volume of the life of Lord Curzon is included an account of the numerous journeys he took as a preparation for his main career. The volume also contains a picture of him as a man. It is therefore, probably more than the volumes to follow, the one in which this Society would be most interested.

Though handicapped from his youth by a severe physical disability—curvature of the spine—Lord Curzon was an inveterate traveller. He covered no actually new ground. But in spite of the pain he must have suffered, he rode long distances in Persia, Central Asia, on the Indian Frontier, and in Afghanistan. And what was chiefly remarkable in his travels was the assiduity with which he worked up his subject beforehand and the irresistible manner in which he overcame those human obstacles which stood in the way of his access to the territories he had set his heart on visiting.

Once he had made up his mind to visit a certain country he would, here in London, read every available book and report about it and make the fullest use of the knowledge already gathered by previous travellers. Then he would have to persuade the authorities concerned to let him visit the region selected. The regions he selected were usually territories involved in some burning political question of the day, and permission to visit them was not easy to obtain. The Government of India, for example, had after deliberation in Council officially informed him that they could not grant him permission to travel to the Pamirs and Afghanistan. But a personal visit to Simla removed that particular obstacle and he made his journey to Hunza, the Pamirs, Chitral, and then to Afghanistan.

No less remarkable than his assiduity in preparing for a journey was his diligence in carrying it out. He was indefatigable in his inquiries and pertinacious—to the point of exasperation—in his arguments about policy with the local officials. But the result was a book full of information and recommending a policy the grounds for which were argued out with great cogency.

This much was perhaps known before. What we are now indebted to Lord Ronaldshay for is bringing out a side of Lord Curzon's character which had not been so well realized. He had undoubtedly a "superior" manner which caused much offence. But he had also this other side which was not so apparent to the public and which it is well should be known. He was, Lord Ronaldshay shows, a genial companion and a staunch friend. He was like a boy in his enthusiasm. Curiously enough he was very sensitive to criticism, and what is most remarkable, he had his moments of humility. Lord Curzon himself has put on record that he was never in the society of able men without recognizing their intellectual superiority.

In the field of geography this trait of humility was certainly evident. He was fond enough of travel and had travelled sufficiently to know what exploration meant. And for explorers he had an admiration in which not the slightest taint of his traditional superiority was to be traced.

For bringing out this side of one of our Presidents this Society owes much gratitude to Lord Ronaldshay.

Lord Curzon's pluck in the face of such severe physical disability as he suffered from throughout his life is too obvious to need emphasis.

FRANCIS YOUNGHUSBAND

CHRISTOPHE COLOMB, CATALAN. By LUIS ULLOA. *Paris: Maisonneuve Frères* 1927. 7×5 *inches;* 401 *pages. Francs* 35

The nationality of Columbus has been hotly disputed during recent years, various delvers into records sustaining theories which would prove the Admiral to have been not a native of Genoa, but a Galician Jew, or a Corsican, or a Greek. The author of the present volume disdains all these suggestions, and contends that Cataluña was his place of origin. Catalans were, he says, considered as "foreigners" in Castile; Colom, the version preferred of the name which history records in so many forms, is a well-known Catalan name; the Admiral used Catalanisms in his writings; and if he concealed his true origin—well, he "had his reasons." What they were the curious reader may ponder for himself, following the Catalan to adventures in Greenland, to changes in nomenclature which transformed him into Xristo-ferens Colon, and in fact to a maze which at least leads twentieth-century investigators an exciting chase.

HUMAN MIGRATION AND THE FUTURE. By J. W. GREGORY, F.R.S. *London: Seeley, Service & Co.* 1928. 9×6 *inches;* 218 *pages; illustrations.* 12*s* 6*d*

We are greatly indebted to Prof. Gregory for this comprehensive study of an extremely important problem. No one who has given any attention to the subject will fail to endorse the tacit approval with which the author quotes (p. 165) one of the conclusions of Mr. Albert Thomas in his address on International Migration at the World Population Conference held last September at Geneva—that the migration problem should be tackled internationally: "the question," he said, "is one of peace or war. If no action is taken, fresh wars, perhaps even more terrible than those which the world has recently experienced, will break out at no distant date." But Prof. Gregory is not blind to the difficulties of the problem. He attributes these in part to the general ignorance of the relevant facts, which certainly cannot be looked upon as an overstatement. The aim of this volume is to dispel that ignorance in some measure, and it may at least be said that we are furnished with enough relevant facts to enable us to see the need for more.

Among the chapters into which the book is divided are several on restrictions on emigration and immigration, one on the safe limits of immigration, and others on the problem as it emerges in several of the countries principally concerned. The penultimate chapter bears the heading "How can the European Need for Emigration be satisfied without International Communism?"

The information that Prof. Gregory supplies is largely in the form of recent statistics of emigration and immigration, but he is of course well aware that such statistics are no sure guide to the amount and direction of international population movements in the future. On that head series of statistics stretching over long periods are much more illuminating, more suggestive of possible causes of change in those movements. In his opening chapter he refers to the fact that these movements themselves have an indirect effect in bringing about such changes through their influence on the birthrate (p. 19). Whatever may be said about the alleged influence of emigration in stimulating the birthrate of the countries from which the emigrants come—an influence in which Malthus believed, and in support of which much more presumptive evidence has accumulated since his time—there can be few readers who will not agree with him in his scornful dismissal of the "startling" contention of Lothrop Stoddard, "that if there had been no immigration into the United States since 1880 the population to-day would be larger" as well as better than it is. This

quotation from Stoddard might well have been omitted, but it is somewhat surprising to be told, as we are in the next sentence, that "the same conclusion was emphatically reasserted by Prof. East at the World Population Conference, and has been repeated in his recent book on 'Heredity and Human Affairs.'" Prof. Gregory was present at that conference and may have heard Prof. East say so, but no such utterance of his can be found in the Report or the Conference, nor is it to be found in the passage referred to (pp. 272–5) in Prof. East's recent book, a passage referring solely to the influence of emigration in the country of the emigrants.

The volume contributes much of value to the study of its subject, but perhaps its chief value will be found to lie in the stimulus it will afford to the further study of population problems, and all interested in such questions will be glad to learn from it that the conference decided to establish a new International Institute for the study of these problems. G. G. C.

FOUR YEARS BENEATH THE CRESCENT. By RAFAEL DE NOGALES. *New York: Scribners.* 1926. 9×6 *inches;* xviii+416 *pages, and illustrations.* $3.50

Born a Venezuelan of Spanish Indian stock, Nogales Bey is the grandson of a Spanish nobleman who espoused the cause of South American independence and became one of the liberators of Venezuela. For him the trail of the sword began as a boy in Cuba, and subsequently it led him to Mexico, Port Arthur, and Korea. At the outbreak of the world war the author was beset by a conflict of sympathies, actuated on the one hand by an inborn zeal for liberty and on the other by the happy recollections of his youth and education in Germany. Having failed to obtain military employment in Belgium, France, Montenegro, or Serbia, he at length found himself in Bulgaria (then still neutral), and there met certain German and Turkish officials, who facilitated his journey to Constantinople, where he was received in the highest German and Turkish circles, and three weeks later once more set off, as an officer of the regular Turkish Army, to fight against the Russians, who were then threatening the safety of Asia Minor. Nogales Bey was thus committed to the cause of the Central Powers, but without having sworn allegiance to their flag or renouncing his Venezuelan citizenship.

Between the beginning of 1915 and the Armistice the author travelled and retravelled the Ottoman Empire. He spent a winter in Erzerum, went through the country of the Kurds, and was Inspector-General of the Turkish Forces in Armenia. With equal readiness he went on a pleasure trip to Beirut, Damascus, and Jerusalem; he fought with the Turks in Iraq, and was present during the more successful period of the Turkish defence of Palestine. Towards the end of the War he secured a post in the Cavalry of the Guard at Constantinople, and in the summer of 1918 obtained leave to visit Germany, where he remained until the collapse of the enemy's resistance in the East. Nogales Bey then returned to Constantinople, where he received his discharge from the Turkish Army, and, meeting certain Allied officers whom he had seen and helped as prisoners during the War, was by them aided to return to South America.

The book is interesting as a supplement to the more important volume recently published in English by General Liman von Sanders, and it should be read by those interested in what took place in Turkey during four eventful and to that country disastrous years. It is well translated from the Spanish, is full of human descriptions by a true lover of adventure, and is nicely illustrated by photographs giving realistic ideas of the peoples and areas described in the letterpress. H. C. W.

GRUNDLAGEN DER ERDBEBENKUNDE. Von B. GUTENBERG. (Sammlung Borntraeger, Band 12.) *Berlin: Gebrüder Borntraeger* 1927. 9×6 *inches;* 189 *pages; text-figures and folding map. M.*6.60

In less than two hundred pages, the author presents us with a clear and concise account of the science of seismology. The book is well illustrated: the sketches and diagrams are clear, the printing is also good, and the general appearance of the volume is pleasing. English students who read German should find it a very interesting and instructive work. All sides of the subject are reviewed, and the author's explanations are simply and clearly expressed. It is, in fact, a book we should like to see translated into English.

The volume is divided into eight main sections, most of which are again subdivided into chapters. Some of the more important matters dealt with include: The nature and effects of earthquakes; the causes of earthquakes and their distribution; instruments used in recording shocks, and the nature and interpretation of the records given by these instruments; the periodicity of earthquakes; determinations of focus and epicentre, and many other features of interest.

In some places the treatment is mathematical. For the most part, however, the general reader should not find the book difficult, and the diagrams are very helpful.

A very useful bibliography is added, and it is a pleasure to note that it is representative of writers other than those in Germany. Quite rightly, we think, it is limited practically to modern literature on seismology. There is also an index. J. A. S.

FROM THE MIDDLE TEMPLE TO THE SOUTH SEAS. By G. ALEXANDER. *London: J. Murray* 1927. 9×5 *inches;* xiv+287 *pages, and illustrations.* 15*s*

Volumes of reminiscences are the vogue, and certainly the writer of this book has spent enough of his life in out-of-the-way places to give interest to most of his chapters. In fact, if he had given more space to the South Seas at the expense of a few recollections of Glasgow and London and England in war-time, his readers might have been more entertained. Most of the book is about Fiji, where Mr. Alexander was chief police magistrate, but in other judicial capacities he visited many Pacific groups and has interesting chapters on the Tonga Islands, the Solomon Islands and the New Hebrides. He went to Vila as Probate judge of the joint court of the Condominium of the New Hebrides, and has much useful criticism to offer of the joint administration as he saw it in pre-war days. Mr. Alexander describes the lingua franca of most Pacific islands as being pidgin English, but the language of which he gives an account is more usually distinguished as Bêche-de-mer English. It differs considerably from the pidgin English of the eastern Asiatic seaports, with its strong Chinese flavour. Only a few words are common to both, and Bêche-de-mer is characterized by the smallness of its vocabulary in which most words are much overworked. R. N. R. B.

THE MONTHLY RECORD

FORERUNNERS OF BRITISH ROAD-BOOKS

Sir George Fordham, who has made so careful a study of the bibliography of British and French road-books and similar publications, has lately lighted on a series of printed road-tables earlier than any previously known to him. In his 'Catalogue of the Road-books and Itineraries of Great Britain' (1924) he had put down the tables printed in Grafton's 'Abridgement of the Chronicles of England,' 1570, and his 'Little Treatise' of 1571, as the first examples of anything of the sort. But he finds that similar tables are given at the end of a series of little historical summaries issued by various printers between 1541 and 1561 under slightly different titles, the best known being perhaps 'A Chronycle of yeres.' A dozen have been so far brought to light, the earliest being printed by John Judson in London, where most of the others also appeared, though issues were made in 1552 and 1553 by John Mychell at Canterbury. Nine principal thoroughfares are dealt with in all of these booklets, with a statement of mileage of the separate stages on each. By tracing their first appearance to 1541 Sir George has established the priority for England in the germ of the modern road-book, though the 'Guide des Chemins de France' of Robert Etienne (1552–3) must still be considered the first road-book proper. He remarks that the selection of the nine roads of 1541 may be traceable back to the Royal proclamations establishing the official Postal service, though none of the early ones appear to have survived. Of the nine the pilgrim way to St. Mary of Walsingham takes the first place, followed by the old north road. Communication with Ireland seems to have been through Carnarvon or Chester, and perhaps alternatively through St. David's. For France, Dover was the only port recognized. Grafton in 1570 added eight roads to London (four being from seaports, and one each from Oxford and Cambridge), as well as a fair number of cross-roads. The title-page and road-tables of the booklet of 1544 are given in facsimile.

FINNISH EXPLORATIONS IN THE UPPER YENESEI BASIN

The Geographical Society of Finland has inaugurated a new series of memoirs, entitled *Acta Geographica*, with a detailed account (running to 186 pages) of researches, mainly geological, carried out by various Finnish expeditions which worked in the upper basin of the Yenesei (the Uriankhai country) between 1917 and 1920. The explorations were begun on the initiative of Prof. J. J. Sederholm of Helsingfors, who acted as chief in 1917, his coadjutors being the geologists H. G. Backlund, S. Foslie, T. Brenner, and H. Hausen. Most of the work in the following years was done by the last named, who gives the account in the *Acta* (of which he is editor) on the basis of the whole body of observations collected. The field of work coincided roughly with that of Mr. Douglas Carruthers and his companions, described in the *Journal* for June 1912, and in the absence of a general map in the Finnish memoir, that of Mr. Carruthers, subsequently published in the *Journal* (April 1913), will be found useful in following Mr. Hausen's descriptions. He begins with a careful account of the physical features of the region, the main characters of which were well described by Mr. Carruthers. The southern part of the Upper Yenesei basin is strangely isolated by mountain ranges, the only outlet for its waters being by the gorge by which the Yenesei breaks through the Saiansk range on the north. The barrier on the south is the Tannu-ola range, dividing the drainage to the Arctic Ocean from the interior basins of Central Asia. On the east the continuation of the Saiansk range, known as the Ergik-Targak-

Taiga, bends south and forms the watershed on this side, while on the west the basin is enclosed by the Seilikhem Mountains.

Broadly speaking, these ranges form uniform uplands of about 6000 feet, the slopes being dissected by narrow, rapidly descending valleys. It is only from a distance that they present the appearance of ranges. Both in the east and west, however, these uplands rise in jagged peaks clad in perpetual snow. The two main branches of the Upper Yenesei are the Bei-kem and the Kua-kem, which unite to form the Ulu-kem above the gorge. The Finnish explorations were mainly concerned with the little-known basin of the Kua-kem, the head-streams of which rise only a few miles from Lake Kossogol, draining to Lake Baikal. In its upper course it runs in a typical mountain valley (almost a gorge), but lower down this broadens and eventually becomes an open steppe. (The region contains a number of such open basins of steppe-character, surrounded by mountains on nearly all sides.) The Bei-kem system (explored by the Carruthers expedition—a fact of which Mr. Hausen does not seem to be aware, though he refers to Carruthers' account of the Uriankhai people) is more complicated, receiving a large number of feeders from the rainy slopes of the Ergik-Targak-Taiga. In his notes on the climate Mr. Hausen dwells on the relative dryness of the Tannu-ola and holds the Saiansk range to be the real divide between the humid mountainous *taiga* * and the Mongolian steppes, considering the Tannu-ola as an isolated oasis in the steppe region. Mr. Carruthers regarded the latter as the true dividing line, marking the final cessation of the forests. According to Printz, the chief authority on the vegetation of the region, a marked desiccation of the forest is in progress. Mr. Hausen has a few notes on the economic position, and says that the effect of Siberian civil wars extended even to this remote district, interfering seriously with his researches. He also gives a useful summary of the history of exploration in the Uriankhai country, some of which is little known, and in part (*e.g.* the surveys of the Finnish explorer Granö in 1906 and 1907) still unpublished. The geological results of the recent expeditions are described in detail and also shown on the three route-maps accompanying the memoir.

THE CAPITALS OF MOROCCO

In a paper read at the Leeds Meeting of the British Association (reprinted in the *Scottish Geogr. Magazine*, January 1928) Miss A. Garnett discusses the historical significance of the positions of the four Moroccan capitals: Marrakesh, Fez, Meknes, and Rabat. The two considerations she emphasizes are the position of Morocco itself as the focus of many routes and as a great storehouse; and secondly its geographical disunity, which in the past has prevented the emergence of a single capital. Marrakesh is the key to the southern area; to the upper waters of the Tensifet lead the transverse Glawi and Kundafi passes from the south. It is the centre of agriculture appealing to the desert peoples, yet not handicapped by lack of water. It is the meeting-point of routes from the southern Sus, Rabat, Fez. The fortunes of Fez and Marrakesh flourished alternatively; for a brief space, in the sixteenth century, with the southern expansion to the Niger, the latter almost established itself as the single capital, until renewed pressure from the Turks in the north revealed the weakness of its position. The Atlas passes become easier farther north, and a longer but less difficult route leads from the Tafilet into the Moluya valley

* Mr. Hausen seems to regard the *taiga* as equivalent to the forested area on the mountains, whereas Mr. Carruthers spoke of it as denoting the naked summits of rock.

and thence by the one break in the Middle Atlas barrier to Taza and the headwaters of the Sebu. It has now joined the most important of Moroccan routes, the "South Rifian highway," running from the Mediterranean coast and Ujda through Taza, Fez to the Atlantic seaboard at Rabat. This was the line of the first Arab invasion in the ninth century, and its importance is demonstrated by the proximity of the two capitals, Fez and Meknes. Fez was placed to close this corridor, and at the same time, after the expulsion from Spain, to check advances from Gibraltar. Only in the nineteenth century, when the sea-coast became the danger line, did Fez relapse from its former importance. Rabat, associated with the neighbouring Sali, has represented foreign domination. For a short space it was created a Moorish capital by Yakub el Mansur, desirous of a capital less distant than Marrakesh from his Spanish frontier. As a capital to-day it has certain handicaps. The neighbourhood is relatively barren, and Casablanca is better placed to tap the grain country of the southern plains. Though it is the terminus of the Rifian route, its connections with Fez, because of topographical difficulties, are not direct. At present, since the mountains are still disturbed, it is on the route from Marrakesh to Fez, but in time this détour should be unnecessary. The writer of the paper therefore suggests that the capital might be moved from Rabat to the more "forward" city, Fez.

NIGERIA UNDER BRITISH RULE: CORRECTION

Sir William Geary writes to point out an error in the review of his book, 'Nigeria under British Rule,' published in the February *Journal* (p. 195). The Royal Niger Company's Charter was revoked as and from 31 December 1899, and not in 1897 as stated in the review. In 1897 the West African Frontier Force was raised at Imperial cost and despatched under Capt. (now Lord) Lugard to occupy effectively the northern areas nominally under the Company's control, but it was not until 1899 that its charter was revoked, and Northern Nigeria was transferred to the administration of the Colonial Office.

'THE COCKSCOMBS REVISITED': ERRATA

Mr. Herbert T. Grant writes to point out that a mistake occurs in the slightly condensed narrative of his journey to the Cockscomb Mountains, British Honduras, published in the December *Journal*. On p. 569, towards the end of the second paragraph, there is the sentence: "On the summit, sloping to its highest point on the west, we cut down the intervening branches to see below us our starting-point of that morning, and 3000 feet above it the great peak itself." Mr. Grant, of course, could not see his camp of the morning below him; he was then facing west, and the camp was several miles behind him, as the sketch-map shows. What he wished to convey in the sentence, of which the above was a summary, was that to reach the summit of Victoria Peak would have necessitated descending to the approximate level of his last camp and then climbing up another 3000 feet. On the same page, in the last paragraph, the "north and eastern faces of Holland Peak" should read "north and western faces"; and on p. 570, line 6, "Allen Peak" should read "Allan Peak." Mr. Grant intends shortly to make another journey to the Cockscombs to collect geological specimens.

THE SOUTHERN LIMIT OF THE BRAZILIAN FOREST

In a short article in *Petermanns Mitteilungen* (73-Jahrg., 1927, Heft 11/12) Dr. K. Wegener discusses the causes of the sudden cessation of the primeval Brazilian forest ("matta virgem") at its southern limit. During a lengthened

stay at Porto Alegre he purchased a small area of 4 hectares on which various types of vegetation were represented, and there studied the conditions of tree-growth and the adverse influences to which it was subject, under the three heads (1) External agencies, such as the attacks of leaf-cutting ants, locusts, and other living enemies, including cattle; (2) the chemical and physical properties of the soil; (3) the climate. Many trees fall a speedy victim to ants while still young, though some species are immune, and in the thick forest the ants are powerless. The composition of the soil is important only as retarding tree growth if unfavourable, but as the hardier kinds prepare the way for the more exacting, forest can establish itself in time anywhere except on sour soils, though certain species may be excluded from others. Of climatic conditions the most unfavourable is the lengthening yearly period of drought to the south, and this proves fatal to many trees unless the ground has sufficient cover to check evaporation. Dr. Wegener concludes that while soil and climatic conditions may cause a gradual diminution of forest towards the south they cannot account for its sudden cessation, which must be due to the agency of external enemies. The "matta virgem" can in fact maintain itself against their onslaughts only on such soil and in such a climate as permit rapid and dense growth and encourage a great variety of species. The sharpness of the division is emphasized by the fact that the good soil becomes still better through the action of the trees, whereas outside the protection of the forest individual seedlings quickly succumb to their enemies. On the other hand, the forest limit may be pushed forward in places, and de-forested ground may be fairly rapidly recaptured.

This strongly marked line of demarcation between the forest and the open country in Southern Brazil recalls Stanley's graphic description of the similar sudden ending of the equatorial forest in Africa.

THE SOILS AND AGRICULTURE OF CUBA.

This question is discussed in the *Geographical Review* for January by Mr. H. H. Bennett, who remarks that probably in no other country has soil character had stronger influence upon national welfare than in Cuba. Many fortunes have been made in the productive red lands, but much has still to be done for the utilization of other favourable types. Cuba still imports much food, and she ought not only to supply her own needs but to expand her exports. Apart from the mountain massifs in the east, there are comparatively few areas of strong relief, and altogether about three-fifths of the island is adapted to the use of any kind of farm machinery, while perhaps half of the rest is cultivable. Of the rougher areas some are forested or could be brought into forest, and a good deal has value for grazing. Much coastal-plain land is uncultivated because of the clogging of the channels of the streams and consequent inundation during the rainy season. Elsewhere the porous red soil absorbs all the rainfall, the only outlet for which is by underground streams: after heavy rains these sometimes boil up through the ground, low wet lands being formed which badly need draining. Mr. Bennett describes the principal soil-areas in turn and supplies the first detailed soil-map of the island, pointing out the need for accurate classification and definition if the best use is to be made of the soils. At present much of Cuba is a prodigious sugar-cane field, for though tobacco is also an important crop the area devoted to it is comparatively small. In 1924 88·4 per cent. of the total exports consisted of the products of sugar-cane, 9·1 per cent. of tobacco and its products, 1·2 per cent. of fruits and vegetables, while all other products made up only 1·3 per cent. between them. But the acreage yield of sugar is low and much might be done to improve the

general position. Inferior soils now cultivated for sugar might be put to better use for timber or pasture, and on the better soil a large increase in the yield might result from improved methods. It is also very desirable that the range of cultivated crops should be widened. Sisal or henequen might be grown much more extensively. On certain red soils Pará rubber would luxuriate under irrigation, while cacao and coffee might recover the position they have lost. Increased cattle and hog-production is also strongly recommended.

THE ADELAIDE REGION, S. AUSTRALIA

We have received from Dr. Charles Fenner a reprint of an article contributed by him to the *Transactions* of the Royal Society of S. Australia. It gives a detailed account of the tectonics and physiographical evolution of the southern portion of the S. Australian rift valley with reference to the development of the area by man. He considers that, though the chief feature is rightly described as a rift valley, it has certain unusual features. On the west, Eyre peninsula, a platform of Palæozoic rocks, is bounded by a fault-line: on the east is the double arc of highlands, in plan resembling an open "3"—the Flinders-Mount Lofty ranges, with an inner arc forming the Yorke peninsula. Thus the fault-lines are not parallel, and the Tertiary plains of the sunkland are divided into two semicircular portions—the "Torrens Sunkland" and the "Spencer-Vincent Sunkland"—connected only by the narrow Port Augusta corridor. The paper deals solely with the "Spencer-Vincent" area, which is worth study since, though but 5 per cent. of the area of the state, it supports 90 per cent. of its population. Within this subdivision the important features are the highly dissected, step-faulted Mount Lofty Range, and the fertile plains lying within this mountain arc and Vincent Gulf, at the apex of which is Adelaide. The southern and steeper portion of the east coast of the Gulf has probably been formed by faulting later than that of the Mount Lofty Range, and may be continuous with the Para fault which farther north is important in the location of Adelaide. To the north the coast is still being elevated, and the general level of deltaic deposits is broken by dunes. The geographical conditions which led to the selection of the site for Adelaide are clearly brought out by Dr. Fenner. A position at the mouth of the Murray was desired, but Colonel Light soon recognized the unprotectedness of the coast, and sought for it in Vincent Gulf. A harbour being essential, the single important estuary, that of the Port River, was selected. Through physiographical developments described in this paper, this estuary is much larger than is necessary for the rivers now entering it, and is moreover practically free from silt, as the Torrens has deposited most of its load before entering it. Further, the Para fault-line, at a point a few miles up the Torrens, offered a site on level ground above the deltaic plains and free from flooding, with sufficient supplies of fresh water. The Mount Lofty range to the east confers many benefits, climatic and economic, upon the Adelaide plains and imposes one considerable disadvantage—in barring communication with the east. Light had expected that the site he selected would communicate easily with the Murray river, but this hope was disappointed. Later the site of the Murray port was chosen almost haphazardly—it grew up below the bridge over the Murray, whose position was determined by considerations of economy in its construction. When the trunk line to the east was built its route across the Lofty range and the Murray river was controlled by local considerations, though in places this meant a compensated grade of 1 in 37. It is pointed out that the great natural unit of the Murray basin is divided among several arbitrary administrative units whose centres are separated from it by

topographical barriers. Adelaide acts to a considerable extent as an outlet for the basin, but a better route over the mountains is required. It is probable that a more southerly route could be found with a compensated grade of 1 in 80. The dominant position of Adelaide as the centre of the State is shown by the fact that 316,865 persons live within the 10-mile city radius, while the remaining population of the State is 249,529 only.

EXPEDITION TO DAVIS STRAIT

Through the courtesy of the Foreign Office we have received details of a Danish hydrographic expedition to Davis Strait which will sail in the early summer. Capt. Riis Carstensen, the leader, will carry out the hydrographical work, and his three companions botanical and chemical research. The purpose of the expedition is to investigate the currents and fishery conditions in the waters west of Greenland and especially north of Disko. The *Godthaab*, on which the party sails, will also carry out fishery inspection. It is stated that the Danish expedition will collaborate with an American expedition which is being sent out by the United States Naval Ice Patrol under Commander Smith, U.S.N., to investigate problems connected with the Labrador currents. Capt. Carstensen's expedition is financed partly by the Danish Government.

FORESTS AND RAINFALL

The long-drawn and on the whole rather fruitless controversy concerning the effect which forests may have on rainfall may be said to be brought to a head by Dr. C. E. P. Brooks in a paper recently read before the Royal Meteorological Society entitled "The influence of forests on rainfall and run-off" (*Quart. Journ. Roy. Meteor. Soc.*, January 1928). The author rightly regards the problem as a general hydrological one, because unless the wider relations are kept in view it is impossible to discuss the purely meteorological aspects to any advantage.

It results from a comparison in many parts of the world between the recorded rainfall in forest clearings and in neighbouring open sites that it is the *catch* rather than the *fall* of rain that is increased within the forest by amounts up to about 10 per cent., the excess being mainly due to the protection of the gauge from air currents. When, however, this protective effect is allowed for there is found a small residual effect of about 1 per cent. increase of actual rainfall due to the forest, an effect approximately what would be expected from the fact that the forest raises the effective height of the ground 30 to 50 feet. Dr. Brooks considers that the powerful mechanical action of forests in collecting water from fog and mists is, except in certain favourable mountain situations, limited to the windward edge of the forest, and so, on the average, not of much importance. Every one knows, however, what invariably happens inside a wood during a fog, and it is possible that this effect is somewhat underestimated by Dr. Brooks. He further reaches the conclusion that whereas forests increase the *local* rainfall by 1 to 2 per cent. in consequence of the increase in the effective level of the ground (orographic effect), the replacement of forests by field crops or grass tends to increase the *general* rainfall of the district slightly, though the replacement by bare ground has the opposite effect. This effect has been shown by Quayle to obtain in the case of the xerophilous Australian forest (see *Journal*, vols. 59, p. 474; 61, p. 64), and Dr. Brooks thinks that it holds, to a smaller extent, even in the case of hygrophilous European forest. Afforestation of grass or crop land, furthermore, increases the local run-off by 10 to 20 per cent., this amount being made up partly by the decreased loss of water in evaporation and transpiration, partly in the slight increase of *local* rainfall.

On the other hand, afforestation of bare ground decreases the run-off, though this effect would be masked by the much greater regularity of the flow.

In the discussion which followed on Brook's paper the writer of this note pointed out that since a forest was itself an adaptation to climate, in equilibrium with rainfall, it was hardly to be expected that any reactive effect of a forest upon the rainfall would be other than of a secondary order, and that this was exactly what Dr. Brooks, employing an abstract method, averaging up all types of forest in all types of climate, had shown. He felt strongly, however, that the matter did not really end there, and that for practical purposes the problem must be dealt with in the *concrete*, each individual forest being discussed on its own merits in relation to climate, soil, and general geographical conditions. Effects of afforestation or disafforestation had, in fact, been shown to vary greatly in accordance with specified geographical conditions. The conclusion, therefore, seemed to be that while Dr. Brooks had answered the question to a first approximation, his method had left untouched various issues that might be of considerable importance in specific practical problems. A forest of any extent must reduce the climatic continentality below what it would be on bare ground of similar area, which means that there are various indirect ways in which wooded country may modify the quantity, character, and seasonal distribution of rainfall.

A GERMAN WOODCUT MAP OF THE 15TH CENTURY

In the *Journal* for July 1927 (p. 93) we referred to some of the map-treasures preserved in the Vadianus Library at St. Gallen, among them being a hitherto undescribed woodcut map of the World bearing a close likeness to that of Hans Rust reproduced in facsimile by Ludwig Rosenthal and spoken of in the *Journal*, 65, p. 469. Dr. H. Hassinger, on whose account of the St. Gallen maps our note was based, has since discussed the St. Gallen woodcut more in detail in the *Zeitschrift* of the Berlin Geographical Society, 1927, Nr. 9/10, his paper being accompanied by a facsimile. The map is pasted inside one cover of a Latin Bible printed at Ulm in 1480 by Johannes Zainer, a miniature of St. Jerome occupying a similar position on the other cover. Its general likeness to the Rust map is so close that a minute inspection is needed to bring out the differences. Inquiries have shown that the Rust map was for a time in the possession of the late Dr. F. von Wieser, to whom the note printed with the facsimile appears to have been due (the map is now in the Pierpont Morgan Library in New York). Still a third example of such a map is to be found in the University Library at Würzburg, again pasted in a 15th-century book, printed in 1473. Like the St. Gallen map it is signed Hanns Priessmaler, with the representation of a spur between, which permits its engraver's identification with the printer Hans Sporer of Nürnberg, whose first known production is of the year 1472, but who first used the sign of the spur elsewhere in the 'Biblia Pauperum' of 1475. As it is unlikely that such a crude idea of the world (evidently a copy of one of the monkish "wheel-maps" of the Middle Ages) could have found a sale in Germany after the publication of the Ulm Ptolemy in 1482, the date of its making seems probably to lie between 1475 and 1482. The identification of Hans Rust was at first more difficult, but a Hans Rist or Riss appears as a burgher of Augsburg between 1477 and 1492, and as a "card-maker" (*i.e.* a maker of playing-cards) is mentioned in the Augsburg records from 1477 to 1484. All therefore points to the late seventies or early eighties of that century as the time in which both maps were made, and this is confirmed by the opinion of competent judges based on the style of the lettering, etc.

The belief that Rust's map was made about 1460 seems therefore untenable. Dr. Hassinger shows reason to think that Sporer copied Rust and not *vice versâ*. Rust gave practically no German place-names, whereas Sporer inserted over a dozen, scattered at random wherever room could be found for them. But as Augsburg takes the place of honour in the centre of the map (next to Jerusalem), it seems probable that Sporer's map was a copy of an unknown second issue by Rust, in which the German names had already been added. Dr. Hassinger gives a careful analysis of the contents of the map and discusses its relationship with mediæval MS. maps such as the Ebstorf map of 1284 and the "Psalter" map of about the same period. Although devoid of scientific value it is of interest as a first attempt to put the old monkish learning in the hands of the public of those days by the aid of the printing press, before the new knowledge finally took its place.

AN EARLY NAUTICAL TERM EXPLAINED

A nautical phrase in Pigafetta's narrative of Magellan's voyage, which has been much discussed by commentators, finds a plausible explanation in an article by Prof. A. Magnaghi in the *Bollettino* of the Royal Italian Geographical Society, 1927, Num. 9–10. After describing the sighting of the two small islands in the Central Pacific, S. Pablo and Tiburones, the writer proceeds "ogni iorno facevamo cinquanta, sesanta, et setanta legue *a la catena ho a poppa*," attributing this rate of progress to the favourable weather. The earlier commentators interpreted the phrase in italics as referring to an instrument of the nature of a log, by which the rate was determined, being misled by the incorrect paraphrase of Amoretti (1801) which ran "secondo la misure che facevamo del viaggio *colla catena a poppa*." Most modern writers have rejected this explanation on account of the total absence of record of the use of such an instrument, either generally at this period or in the details of the nautical outfit for this voyage; but as it has not yet been entirely abandoned, Prof. Magnaghi puts forward abundant reasons for finally rejecting it. He also rejects as unsatisfactory the explanations suggested some years ago by Uzielli, and comes back to the more literal interpretation that the ships made various rates of progress according as they sailed with the wind due astern ("a poppa," used elsewhere in this sense) or otherwise. This view finds support from the French text printed by Denucé, in which *a la catena* becomes *a l'orce*, showing that the former phrase can hardly have been used in the actual MS. from which the French text was made. The phrase "all'orza" (literally "by the bowline") had the recognized meaning of a course sailed with the wind at an angle with the desired direction, and in this sense it is actually found contrasted with the more favourable condition "andando col vento in poppa." This gives no clue to the precise meaning of the phrase "a la catena," which cannot be found elsewhere in the writings of the time, and Prof. Magnaghi makes the ingenious suggestion that it is a misreading by a scribe of an original *a lantena*, "antenna" (mast or yard) being here used as an equivalent for the more usual "orza" attached to it.

CENTENARY OF THE BERLIN GEOGRAPHICAL SOCIETY

The *Gesellschaft für Erdkunde* will celebrate the centenary of its foundation from the 24th to the 26th of May, and in response to an invitation, transmitted through the German Embassy in London and the Foreign Office, the Council have appointed our Foreign Secretary, Sir Maurice de Bunsen, and one of our Vice-Presidents, Dr. Hugh Robert Mill, to represent our Society at this celebration, with a Member of Council, Rear-Admiral Douglas, who is also

representing the Admiralty. A special feature of the meeting will be a conference on the scientific exploration of the ocean, at which the results of the recent German Atlantic Expedition in the *Meteor* will be a principal subject of discussion.

OBITUARY

SIR ALBERT GRAY, K.C.B., K.C.

THE death of Sir Albert Gray on February 2, at the age of seventy-seven, has caused deep and widespread regret, not least among the Fellows of this Society, which he had joined thirty-eight years ago. In 1912 he was chosen a member of its Council, doing valuable service in this capacity for the next three years.

Sir Albert was born on 10 October 1850, being the fourth son of Mr. George Gray, of Bowerswell, Perth. Educated at Rugby, he joined the Ceylon Civil Service in 1871, but resigned in 1875, though retaining through life the interest in things Eastern which he had acquired during his four years' residence in that island. In 1879 he was called to the Bar at the Inner Temple, becoming a Bencher in 1914. After practising on the South-Eastern Circuit and becoming Chancellor of the Diocese of Ely in 1894, he was appointed in 1896 Counsel to the Chairman of Committees in the House of Lords, doing efficient service to successive holders of that office until his retirement in 1922, and becoming widely known in Parliamentary and social circles.

Sir Albert Gray's association with geography arose primarily from his interest in old travel. He had joined the Hakluyt Society in 1877, and a few years later undertook to edit for it (assisted by Mr. H. C. P. Bell, of the Ceylon Civil Service) an English translation of the narrative of the French traveller Pyrard de Laval, who had sailed to the East in 1601 and went through many adventures in the Maldive Islands, India and the Archipelago, finally returning home by way of Brazil. The three volumes occupied by the narrative, with the editor's introductions and explanatory notes, are among the best published by the Hakluyt Society, and reveal the wide range of Sir Albert's research and knowledge of Eastern history and characteristics. In 1887, the year in which the first of these volumes appeared, he joined the Council of that Society, becoming its President in 1908 on the retirement of Sir Clements Markham. During the eighteen years in which he held the post he had always its interests at heart, and endeared himself to his colleagues by his charm of manner and unfailing courtesy. Although he edited no further volumes for the Society he did much quiet work behind the scenes in the way of reading and in some cases actually revising MSS. submitted for publication. Another contribution to the history of travel, outside the activities of the Hakluyt Society, was the admirable introduction which he wrote for the Argonaut Press edition of Dampier's voyages, published in 1926, and he was understood to have in hand a similar piece of work for one of the forthcoming volumes.

As a lawyer, Sir Albert's interests touched geography also on its political side, as concerned with international relations, boundary questions, and the like, and this *Journal* not infrequently had the benefit of his knowledge and judgment on such matters. He was a zealous champion of the protection of the native fauna of Africa and other parts of the world threatened by the encroachment of civilization, and was also much interested in the improvement of housing conditions in Chelsea, where he had long resided and of which he was Mayor in 1924–25. He married in 1895 a daughter of Mr. S. Wells Williams, of the U.S. Legation at Peking, who survives him.

Col. J. P. KOCH, R.D.I.

One of the most meritorious of the many Danish Explorers of Greenland, Col. J. P. Koch, died at Copenhagen early in January of this year, and the news has been received with great regret by all interested in Arctic exploration. Born at Vestenskov, on the island of Laaland, on 15 January 1870, he had only reached the comparatively early age of fifty-eight. Koch's greatest feat was no doubt the crossing of the inland ice of Greenland at about its widest part in 1913, but this was by no means his first contribution to the exploration of that vast Arctic land. In 1900 he had taken part in the voyage to East Greenland at the close of the systematic exploration undertaken by Lieut. G. C. Amdrup in 1898–1900 under the auspices of the Carlsberg Fund, his special task being the survey of the little-known coast between 69° 20′ and 72° 20′ N. Still more important work was done during the expedition of Mylius Erichsen in the *Danmark* in 1906–8, Capt. Koch being now at the head of a party of six topographers, and the cartographical results of the surveys were among the most important till then brought home from North-East Greenland. Having superintended their publication, besides collaborating with his colleague, Dr. A. Wegener, in the preparation of a memoir on the glaciological observations of the expedition, the explorer made plans for an important expedition on his own account, the two principal objects aimed at being a thorough examination of Queen Louise Land (visited by the previous expedition) during the winter and early spring of 1912–13, and a traverse of the whole extent of the inland ice-sheet from east to west in the summer of the latter year. With the help of three colleagues (one being again Dr. Wegener) both objects were successfully accomplished, in the face of great difficulties, and Capt. Koch gave striking proof of his hardihood and determination by persevering in his journey across the ice after being laid up for three months with a broken leg. The route led across the most elevated part of the ice-sheet (the highest point reached being little short of 9000 feet above the sea) and involved unusual dangers and hardships, the party being quite at an end of their resources when they finally struggled into Proeven near Upernivik on the west coast. It should be mentioned, as an instance of Capt. Koch's ardour for travel and exploration, that he effected a complete double crossing of Iceland, by the Odadahraun and the Vatna Jökull, *en route* for the scene of his more important enterprise. (He had previously, in 1904, carried out surveys in the region of the Öræfa Jökull for the Danish general staff.) His mantle as an explorer has fallen on his nephew Lauge Koch, who received the Patron's Medal of the Society last year in recognition of his valuable work in Greenland.

Sir AUBREY STRAHAN, K.B.E., SC.D., F.R.S.

We record with great regret the death of Sir Aubrey Strahan on March 4 last at the age of seventy-five. He was educated at Eton and St. John's College, Cambridge, and, after taking the Natural Science Tripos, entered the Geological Survey of England and Wales. After serving as Assistant Director, he ultimately succeeded Sir J. J. H. Teall as Director in 1913, from which post he retired in 1920. Sir Aubrey occupied many positions in the scientific world, among others that of Vice-President of the International Geological Congress in 1913, and President of the Geological Society in 1913–14, receiving the Wollaston Gold Medal in 1913.

Among the publications of the Geological Survey for which he was more immediately responsible were the series of Memoirs on the South Wales Coalfield, on which, as on the general question of the British coal-supply, he was

a foremost authority, serving on the Royal Commission which dealt with the subject in 1903. His geographical interests naturally lay chiefly on the physical side. In 1896 he took part in the expedition to Northern Norway for the observation of the solar eclipse, and he seized the opportunity to make a careful examination of the raised beaches, as well as the very ancient glacial deposits, of the Varanger Fiord. In 1902 he published in the *Quarterly Journal of the Geological Society* a paper on the South Wales river-system and its connection with that of the Thames and Severn. Being of necessity built a good deal on hypothesis, his views on this question did not meet with acceptance in all quarters.

Having been elected a Life Fellow of this Society in 1898, Sir Aubrey Strahan served on its Council in 1907–10, and again in 1918–22, and was closely identified with the work of the Research Committee, the meetings of which he attended regularly. On three occasions between 1906 and 1911 he reported to it upon the progress of the Committee on the Investigation of rivers, which was largely established through his instrumentality, and on which he was associated with Prof. Herbertson, Dr. H. R. Mill, and others. In 1909 and 1910 he acted as Chairman of the Research Committee.

MEETINGS: SESSION 1927–28

Sixth Afternoon Meeting, 26 March 1928. Sir Charles Close, President, in the Chair

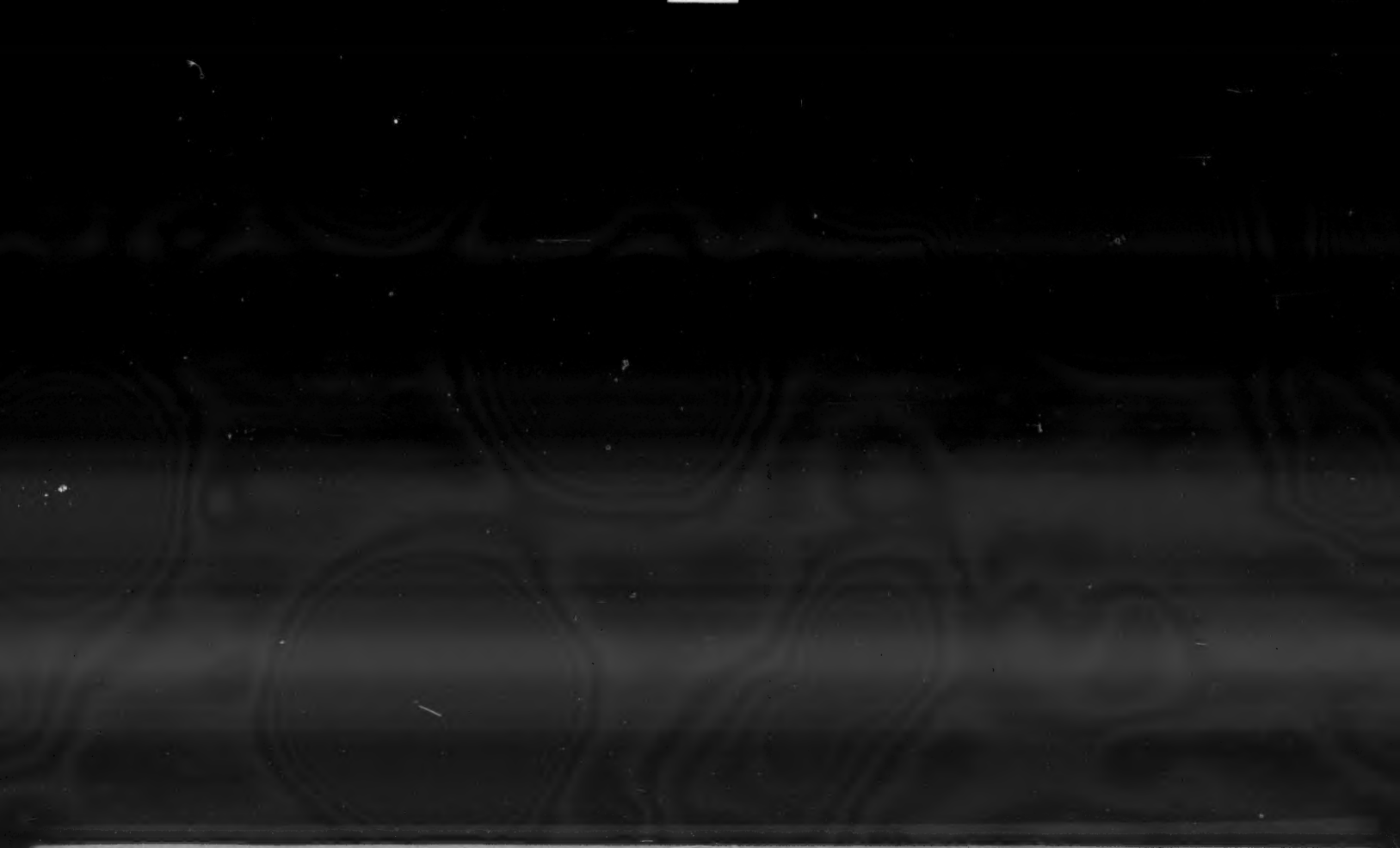
Paper: A topographical study of the flood-swept course of the Porth Llwyd above Dolgarrog. By Prof. W. G. Fearnsides and Mr. W. H. Wilkinson

Eleventh Evening Meeting, 2 April 1928. Sir Charles Close, President, in the Chair

Elections: Capt. L. Y. Andrews; Capt. P. F. Borradaile-Speedy, F.R.S.A.; Capt. J. F. Bowerman, I.A.; Lieut. Warren Roger Caborne; Harold J. Coolidge, Jnr.; James Eddy Ellis; Capt. William Lashley Emtage; The Rev. George McPherson Hunter; Paul Meyrat; The Rev. Everard Roy Moon, M.A.; The Rev. William Orr Mulligan, M.A., B.D., LL.B.; Miss Doreen Newall; Ralph Western Ramsden; The Rev. Arthur Taylor; Johannes Gerhardus van Alphen, B.A.; William Stix Wasserman, A.B.

Paper: The work of the R.R.S. *Discovery* in the Falkland Island Dependencies. By Mr. A. C. Hardy

Twelfth Evening Meeting, 23 April 1928. Sir Charles Close, President, in the Chair

Elections: John Whittle Cattermole; Kingsley Osbern Nugent Foster; Captain Duncan Henderson, M.C.; Oswald Lewis; Miss Helen Isabella Milne; John Pemberton Nelson; The Rev. H. Lawford Nicholls; The Dowager Lady Swaythling; E. A. Temple-Perkins; The Rev. Joseph John Williams

Paper: Journeys among the Southern Tuareg. By Mr. Francis Rodd